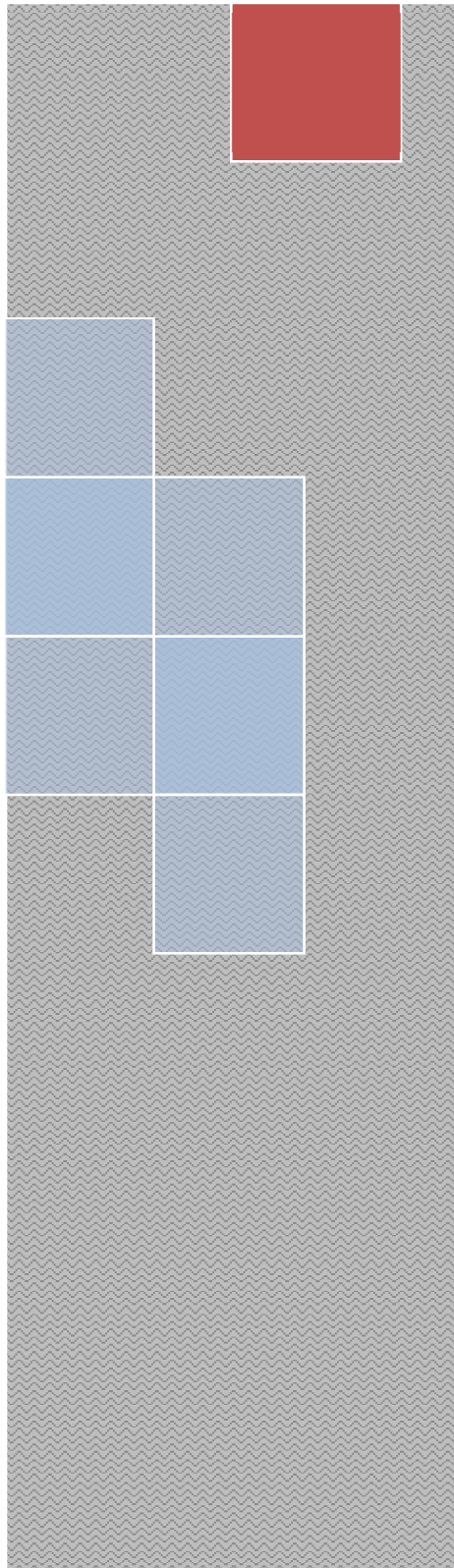




VOLUME – IA Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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VOLUME - IA PART – I CHAPTER – I

1.1 PROJECT INFORMATION

1.1.1	PROJECT TITLE	:	KUDANKULAM NUCLEAR POWER PROJECT UNIT 3 & 4
1.1.2	PLANT CAPACITY	:	2X 1000 MWe
1.1.3	TYPE OF PROJECT	:	GREEN FIELD
1.1.4	OWNER	:	NUCLEAR POWER CORPORATION OF INDIA LIMITED
1.1.5	PLANT LOCATION	:	KUDANKULAM PO, RADHAPURAM TALUK, TIRUNELVELI DISTRICT, TAMILNADU - 627106
1.1.6	NEAREST TOWN	:	NAGERCOIL (41KM)
1.1.7	NEAREST RAILWAY STATION	:	KANYAKUMARI (35KM)
1.1.8	NEAREST AIRPORT	:	TUTICORIN (131KM)

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VOLUME-IA PART-I CHAPTER – II

1.2 SCOPE OF WORKS

- 1.2.1 The Handling, transportation, pre-fabrication, assembly, erection, welding, NDT inspection & testing of piping and erection of associated equipment along with accessories, structures, insulation for nuclear and nuclear auxiliary systems in reactor auxiliary buildings, safety system building, solid radioactive waste reprocessing & storage building and new fuel storage building.
- 1.2.2 Procurement, supply and erection of structural steel materials required for supports & structures and carrying out insulation works of piping & equipment. For further details regarding scope of work of supply and erection, clauses related to Free issue materials (FIMs), other relevant clauses and BOQ shall please be referred.
- 1.2.3 **CONTRACTOR'S SCOPE OF WORK.**
- 1.2.3.1 **GENERAL**
- 1.2.3.1.1 In general, the contractor's scope of work comprises, but not limited to the following Study, Preparation and Submission of detailed work schedule such as level 3 and level 4 to meet the specific targets and agreed milestones as per contract. All work schedules and networks shall be prepared based on actual quantum of work indicating resources required by the contractor to achieve the agreed targets.
- 1.2.3.1.2 Training and qualification of contractor personnel. The contractor personnel shall be conversant with Russian codes and standards. Contractor quality personnel shall be assessed before engaging them in work and execution engineers & supervisors will be checked for relevant & adequate experience for the assigned work.
- 1.2.3.1.3 Coordinate in preparation of work procedure for the Jobs of general in nature and also separate work procedures & erection methodology for jobs of specific/critical in nature.
- 1.2.3.1.4 Arranging necessary Plant & Machinery (P&M), tools and tackles for execution of the work. In addition to the regular tools and tackles, works demands arranging special P&M, slings & bow shackle for heavy equipment erection, electrical winches for movement, compact hydraulic jacks, oil free air compressors.
- 1.2.3.1.5 Establishing contractor office and other infrastructure with communication facilities, storage area (covered & open), outdoor shops, machine shop, electrode storage room with controlled atmosphere, dark room facility for Radiography testing, radiography source room, labour canteen, rest room.
- 1.2.3.1.6 Receipt of free issue material from BHEL/NPCIL stores, inspect, transport the material such as equipment, pipe, pipe fittings, valves & other accessories, supports, insulation, welding electrodes/filler wires etc. to contractor's stores, preparation of Incoming materials inspection report (IMIR) for the received material. Discrepancies and defect

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found (if any), shall be brought to the notice of BHEL/NPCIL to resolve the issue as per the established procedure.

- 1.2.3.1.7 De-preservation, cleaning, fabrication, welding, inspection, erection and testing of pipelines & associated specialties, hangers and supports.
- 1.2.3.1.8 Erection of associated equipments along with accessories, inspection & quality assurance of material & work.
- 1.2.3.1.9 Fixing of Hilti make anchor fastener wherever embedded fastener/plates are not available as per approved drawings.(Hilti anchor fasteners will be supplied by NPCIL on free issue basis)
- 1.2.3.1.10 Supply of consumables (like argon gas, acetone, high quality kerosene & lubricant), welding electrode & filler wire for welding of contractor supplied material, fixtures & accessories etc. are in the scope of the contractor and cost is deemed to have been included in the quoted rates. Only NPCIL approved welding consumables shall be used.
- 1.2.3.1.11 Non-destructive examination (NDE), pressure and leak testing including supply of machineries, instruments and qualified manpower.
- 1.2.3.1.12 Grit blasting & application of primer on structural steel members/support elements etc.
- 1.2.3.1.13 Supply and application of Epoxy paint on pipelines support and metal structures.
- 1.2.3.1.14 Supply and application of paint as instructed by engineer on equipments and piping supplied which might have damaged during transportation & erection. Cleaning and touch-up painting of all such items shall be in contractor scope.
- 1.2.3.1.15 Supply, transportation, storage, fabrication, welding, erection and inspection of carbon steel structures for pipe supports and metal platforms.
- 1.2.3.1.16 Supply, transportation, storage, prefabrication & application of hot and cold thermal insulation on equipments and piping systems.
- 1.2.3.1.17 Passivation of stainless-steel components at contractors' shop and in-situ as directed by the engineer.
- 1.2.3.1.18 Supply of natural/SBR rubber sheet of required thickness as specified in the drawing with minimum width of 1000mm, with shore hardness of 65 +/-5 shore A. Density 1.5 to 2 g/cc.
- 1.2.3.1.19 Supply of Aluminum foil 0.1mm thick for required width & length conforming to IS737-2008.
- 1.2.3.1.20 Grouting/dry packing for equipment as per Engineer's specification including supply of material.
- 1.2.3.1.21 Machining of various components (turning, milling, grinding & drilling etc.) as instructed by the engineer.
- 1.2.3.1.22 Preparation and submission of circuit release report (CRR) for taking up hydro testing of completed systems in CMS, submission of reports concerning the quality assurance and completion of work.
- 1.2.3.1.23 Providing qualified, skilled and unskilled manpower, experienced and qualified supervisory and technical staff and competent management fully backed by latest

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project management tools and facilities for efficient and safe working and committed to total quality management.

1.2.3.1.24 Providing qualified safety personnel as per specification to ensure incident free execution of work at site as well as at contractor shop.

1.2.3.1.25 Providing trained skilled and unskilled persons to upkeep the building & floors in neat and hygiene condition during execution of work.

1.2.3.1.26 The provision of all equipments and facilities to perform all the specified work, including any temporary or special devices that may be necessary, storage, site workshop, welding machines and apparatus, consumable supplies in general and specifically for welding, threading, hoisting and transportation of equipment, scaffolding, temporary protection where called for in specification, all equipment and consumables for destructive and non-destructive testing, examination and inspection and temporary arrangement and provisions for pressure and leak testing, facilities for clean shop with air washing and filtration facilities and cleaning of the pipelines including consumables supplies for the same and the facilities such as De-mineralized water, oil free compressed air unit.

1.2.3.1.27 In general, all materials and services whatsoever necessary for satisfactory completion of the work, unless specifically provided as the free issue material by the engineer, are deemed to be included in the contractor's scope of work.

1.2.3.1.28 The major buildings covered under the scope of this tender are Safety system building (UKA), Reactor Annex building (UKB), Reactor Auxiliary building (UKC), Piping gallery & trestle (UJY), solid radioactive waste reprocessing & storage building (UKS) and New fuel building (UFC). Work pertaining to the scope of this contract shall be in the buildings but not restricted to the above. The detailed description of above buildings and process systems covered in this tender is elaborated in technical specification & scope of work detailed chapter.

1.2.3.2 **RECEIPT, TRANSPORTATION AND STORAGE OF FREE ISSUE MATERIAL**

1.2.3.2.1 Free Issue Material (FIM) issued by BHEL/NPCIL. BHEL/NPCIL will issue material along with copy of SSIR (Site Store Inspection report) and packing list. The free issue material will be issued against contractor's Issue Voucher (CIV) from BHEL/NPCIL stores. The contractor shall prepare CIV either using NPCIL in house software's like IBA-CMM or other software platforms supplied by the BHEL.

1.2.3.2.2 In case BHEL/NPCIL provides the material management software, contract shall arrange all necessary infrastructures (computer terminals, network, and other hardware) and manage free issue material/contractor supplied material through the same.

1.2.3.2.3 Briefly the scope of material transportation covers identification of material, preparation of CIV, clearance from EIC (Engineer In Charge) and its submission to BHEL/NPCIL's Stores, receipt, handling, loading on to the truck/trailer, transportation of materials from BHEL/NPCIL's stores to contractor's store or erection site, unloading the material at

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contractor's store or erection site, uncrating, checking the completeness of items/physical damage(if any), preparation and submission of incoming material inspection report (IMIR) and its clearance from EIC, further shifting of materials from contractor's store to erection site and disposal of the crating/packing material at the designated place of the BHEL/NPCIL's stores, returning of un-erected (balance) materials to BHEL/NPCIL's stores. This work also includes arranging all the necessary tools and tackles, truck/trailer, plant and machinery, man power and consumables.

1.2.3.2.4 The FIM shall be issued in a lot, in packed (as received condition) or Individual component wise. In case if the issued package contains material belonging to other agencies/spares it shall be returned to BHEL/NPCIL stores immediately in consultation with engineer in charge.

1.2.3.2.5 Materials are to be handled using appropriate material handling equipments and tools. Under no circumstance's materials shall be dropped. Pipe handled on skid ways shall not be skidded or rolled against other pipe. Dragging of unprotected equipment on the ground shall not be permitted.

1.2.3.2.6 For measurement of transportation stage payment of pipeline & equipment, only net weight of equipment /pipeline, pipe fitting, supports, valves (for all free issue material) will be considered. Weight of crating/packing materials will not be considered for measurement & payment. The weight mentioned in the Manufacturers passport documents only will be considered for measurement purpose. In case if it is not available in the passport the order of priority is packing list weight, working document and physical measurement.

1.2.3.3 **STORAGE OF MATERIALS**

1.2.3.3.1 The contractor shall make his own arrangements for constructing covered storage area on earmarked open space made available to the contractor at site. Attention is drawn to the fact that the environment at KK site is corrosive and therefore proper storage and its periodic monitoring by contractor has to be done at no extra cost. Contractor shall make closed warehouse shed on his own to provide appropriate storage at site for all NPCIL issued material till the completion of the work as per BHEL/NPCIL recommendations. All the Plant & machinery, tools & tackles, hoisting equipments, manpower etc required for handling the materials at contractor's store are in the scope of the contractor. Watch and ward shall be the responsibility of the contractor.

1.2.3.3.2 Once materials are issued to the contractor it is the responsibility of contractor to safeguard the materials and pre-fabricated items against damage, environmental effects by keeping the material inside the building or by enclosures providing adequate protection. All storage shall be orderly and executed in a way so as to eliminate mixing up of materials (through proper codification and BIN card system) and possibility of damage prior to their installation in the field. Valves shall be stored in specially designed stands to protect rubber parts/ machined surfaces. No material shall be stored directly

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on the floor. Supports shall be provided to ensure Gap of 250 to 300 mm from ground. For Materials received for fabrication, such as pipes and fittings, all identification marks pertaining to material specification and other details shall be retained until such time when it is inevitable to remove them during pre-fabrication stage (such as cutting). Special tags bearing system code numbers provided on equipment, pipe fittings and items like valves, etc. shall not be removed or tampered with. Lack or loss of above described identification marks shall be brought to the attention of the engineer.

1.2.3.3.3 The Contractor shall be responsible for security of all the FIMs stored at the contractor's stores till the completion of the work and acceptance by BHEL/NPCIL. It is the responsibility of the contractor to maintain complete record of the list of materials at stores, maintain log books and entry/exit records for the material movement in and out of the contractor's warehouse/ store. BHEL/NPCIL approved committee has every right to audit Contractor stores, records and his logbooks time to time during the execution of work, for which Contractor shall ensure and provide all such information and facilities on demand.

1.2.3.3.4 A few equipments/components require temporary locking arrangement till erection. In such cases contractor shall take adequate care to prevent damage and item shall be stored with their original locking till erection of such component.

1.2.3.4 **IDENTIFICATION, MARKING AND SEGREGATION OF MATERIAL AND INCOMING MATERIAL INSPECTION (IMIR)**

1.2.3.4.1 In BHEL/NPCIL stores, all the equipments and pipelines are identified by their KKS codes and Item nos. It is the responsibility of the contractor to get the details of KKS codes, package no's, Item no's for such materials from BHEL/NPCIL. All the FIMs shall be stored at appropriate locations in contractor's stores, tagged and identified for segregation from other goods, protected and preserved as per manufacturers recommendations, marked with their KKS code, system Code, item no. and item description like weight, material, type etc and the material locations shall be marked for easy identification and retrieval of the material at stores. Each piece of pipe, regardless of length, and each fittings or other component part, except minor fasteners, shall be clearly identified by legible marking on the part.

1.2.3.4.2 The contractor shall visually examine all materials being erected or being used in the fabrication and shall report any defects to the engineer. Any repair of materials shall be as per approval of the engineer's instructions. Any material not conforming to the specification and subsequently rejected should be suitably identified, stocked and disposed off as per the instructions of the Engineer.

1.2.3.4.3 All loose parts/ accessories such as gaskets, diaphragms, seals etc. of valves and other equipment shall be properly identified, stored and re-assembled by the contractor under supervision of engineer.

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1.2.3.5 **PREPARATION OF WORK PROCEDURES, QAP AND JHA**

1.2.3.5.1 Contractor shall support BHEL in preparation of Quality assurance plan, erection methodology, welding & work procedures to meet the requirement specified in the Working Drawings, manufacturer document & drawings such as assembly & erection instruction & passports which will also include good & safety practices and principles. JHA for all works involving hazard shall be prepared with required precautions & actions required from the contractor.

1.2.3.5.2 For some critical work, requirement of multiple procedures exists for erection of equipment due to complexity in the nature of work.

1.2.3.6 **ERECTION SCHEDULE AND SEQUENCE OF ACTIVITIES**

1.2.3.6.1 The milestone to be achieved by the contractor is specified in the tender. Based on the project schedule engineer will issue WD (Working Document), material and work front and broad sequence of activities is specified in the tender technical specification of various equipment / items. The contractor has to study and submit a detailed work schedule with network of activities such as level 3 and level 4 to meet the specified targets. All work schedule and network shall be prepared based on logical sequence of activities, quantum of work with required resources (manpower & machineries) to achieve the agreed target. ENC reserves the rights to audit and review the said resources of the contractor from time to time during the execution of the work for which contractor shall ensure and provide all such information and facilities on demand. Contractors have to submit the weekly, monthly, quarterly rolling schedule based on actual physical progress of the work.

1.2.3.6.2 Contractor shall make all arrangements for working in round the clock basis to achieve the targets.

1.2.3.6.3 The sequence of erection shall be decided in consultation with Engineer based on availability of erection fronts, drawings and equipments. In general, the sequence of the erection shall follow the overall project schedule of KKNPP-3&4. Generally, erection of equipments shall be taken up first followed with erection of piping, support and valve system. The following shall be the preferred sequence of installation.

- a. Equipment erection and inspection
- b. Erection and inspection of supports for large diameter piping.
- c. Erection of pre-fabricated large diameter piping spools (100 NB and above) and supporting them on already installed supports.
- d. Erection and field welding of the remaining piping (small diameter) and erection of their supports.
- e. Preparation of circuit release report & Testing of piping Circuits / systems.
- f. Application of Painting, thermal insulation on tested systems.

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1.2.3.7 **INTERFACING WITH OTHER AGENCIES AND TERMINAL POINTS**

1.2.3.7.1 Civil construction work of buildings covered under this contract is already awarded and work is under progress by other agencies. The mechanical contractor shall note that the construction of civil works shall be continuing in other part of the same building where equipment and piping being erected, this type of parallel working shall not be considered as disturbance or hindrance to erection work. Also, other mechanical/electrical agencies related to ventilation, material handling equipments, common services, cable laying, ducting etc may also work in the same area. Hence for carrying out the above activities co-ordination with other contractors/agencies working in that area will be required.

1.2.3.7.2 The civil construction and mechanical erection works shall be done in a sequential/combined manner. The rate quoted by bidder shall consider all factors affecting progress of work due to parallel (combined) working of civil, mechanical, electrical and instrumentation agencies. No extra claim on account of any misunderstanding or not understanding the nature of work shall be entertained by BHEL.

1.2.3.8 **TERMINAL POINTS**

1.2.3.8.1 The terminal points for the system piping with respect to the buildings shall be indicated on the working drawing. Generally terminal points shall be considered as equipment /pipe nozzle, pipe penetration or the first isolation valve. Alignment, fit-up and welding at all the terminal points and bolting in case of terminal flange joints with the other systems/agencies is included in Contractor's scope of work. Cutting/opening of existing blanks of equipment (as per Engineer's instructions) at such terminal points, if required shall be considered as part of erection and these shall be made by the contractor at his own cost.

1.2.3.8.2 The pipelines crossing the boundary of the buildings generally will be terminated one meter away from the wall either inside or outside of the building. Contractor shall connect pipelines under his scope of work to these lines as per the WD.

1.2.3.9 **RUSSIAN EQUIPMENT MANUFACTURER'S INSTRUCTION AND SUPERVISION AT SITE**

1.2.3.9.1 Manufacturer's instructions/drawings (passport) are issued by the equipment manufacturer, in addition to the requirements specified in the working document, related to installation at site. Such installation requirement specified by the manufacturers, such as sequence of erection, alignment, adjustments, preservation, turning of motors, mounting of accessories on the equipment etc. is included in contractor's scope of work. Similarly, for valves any instructions regarding welding in open, partially open or closed position or dismantling, storage and assembly, etc. shall be strictly adhered to and shall form part of contractor's scope of work. Adequate care shall be taken during welding of valves.

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- 1.2.3.9.2 BHEL/NPCIL will deploy the RF design/equipment manufacturer representative to oversee the erection of specific/special equipments, piping etc, supplied by them to validate the fulfilment of the requirements specified by them in order to provide the guarantee to the supplied item. The manufacturer representative will be deputed for limited period of time, it is essential that contractor shall complete the work within schedule agreed. Also Russian representative will seek the necessary reports/methodology stage wise to proceed for subsequent activities. The contractor shall meet these requirements to get the clearance from RF representative for continuing the erection work.

1.2.3.10 **QUALITY ASSURANCE**

- 1.2.3.10.1 The work under this contract covers the reactor and reactor auxiliary systems, which demands highest degree of quality and reliability standards. In line with these requirements, the contractor shall have documented quality assurance system to assure the quality at all stages of procurement, handling, storage, cleaning, pre-fabrication, welding, erection, inspection and testing.
- 1.2.3.10.2 The Contractor shall have a dedicated group of experienced and qualified inspection engineers and inspectors responsible for assuring quality assurance and quality surveillance program at their work, their vendors/manufacturing works and fabrication, welding, inspection, erection and testing work at site. They should have adequate quality control engineers/agency to carry out inspections as per quality assurance plan.
- 1.2.3.10.3 BHEL/NPCIL shall carry out audit in all phases of the work i.e. procurement, pre-fabrication, erection, inspection, examination and testing.
- 1.2.3.10.4 BHEL/NPCIL or its authorized representative(s) shall carry out Quality surveillance in all phases of the work. They will have free access to all areas where works involving the concerned contracts/purchase orders are in progress.
- 1.2.3.10.5 Quality surveillance by BHEL/NPCIL or its authorized representative includes, but is not limited to, Witness and Hold Points.
- 1.2.3.10.6 Witness Points are critical steps in erection/manufacturing and examination/inspection/testing where the contractor/supplier is obliged to notify BHEL/NPCIL or its authorized representative in advance of the start of operation/test so that it may be witnessed. The contractor/supplier may proceed with the work past a Witness Point if the NPCIL QS or its authorized representative is not available at the appointed time.
- 1.2.3.10.7 Hold Points are critical steps in erection/manufacturing and examination/inspection/testing where the contractor/ supplier is obliged to notify BHEL or its authorized representative in advance of the start of operation/test so that it may be witnessed. The contractor/supplier is not to proceed with the work past a Hold Point except by written waiver/agreement by BHEL/NPCIL.

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- 1.2.3.10.8 The performance (or waiver) of quality surveillance activities by BHEL/NPCIL, QS or its authorized representative does not relieve the contractor of any obligations to meet all requirements of the working document.
- 1.2.3.10.9 Contractor shall offer various surveillance points to BHEL/NPCIL only after due concurrence/ clearance from their execution and QA group.
- 1.2.3.11 **NON-DESTRUCTIVE EXAMINATION**
- 1.2.3.11.1 Non-Destructive examination shall be carried out on all the weld joint performed. The scope and extent of NDE shall be as per the working documents and manufacturer instruction.
- 1.2.3.11.2 Non-Destructive Examinations of equipments and pipelines shall be performed by the requirements prescribed in working documents. The quality of weld and extent of Non-Destructive Examinations coverage are based on the category of weld which are defined as follows
- a. Category I Welded joints for equipments and pipelines for Group A (Safety class I and Quality group A)
 - b. Category II Welded joints for equipments and pipelines for Group B (Safety class II and Quality group B)
 - c. Category III Welded joints for equipments and pipelines for Group C (Safety class III and Quality group C)
- 1.2.3.11.3 The welded joints not categorized as above shall be termed as Quality not categorized (QNC) category and the requirements will be as per working drawings and functional requirements or as directed by engineer.
- 1.2.3.11.4 With regard to the scope of inspections, the Non-Destructive Examinations is subdivided into 100% inspection and selective inspection (Scope 50%, 25%, 15%, 10% & 5%) depending on category of weld.
- 1.2.3.12 **TEMPORARY PIPING, FLUSHING AND NORMALIZATION OF SYSTEM:**
- 1.2.3.12.1 On completion of erection, welding, inspection and testing of systems and before handing over for commissioning, flushing of piping system shall be carried out. During flushing some equipments needs to be bypassed for which temporary piping shall be carried out. Scope of this work includes receipt of material from BHEL/NPCIL stores, fabrication, erection, welding and inspection of temporary piping.
- 1.2.3.12.2 In addition to the bypass arrangements there may be requirements for temporary piping such as dewatering, drain collection etc.
- 1.2.3.12.3 Erected piping systems shall be flushed with DM water to ensure the cleanliness of the piping. Flushing shall be carried out both on the carbon steel and stainless steel piping systems.

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- 1.2.3.12.4 Prior to carrying out flushing, all the equipments such as pumps, heat exchangers, tanks etc shall be by passed with temporary piping. Approved flushing scheme shall be obtained from the respective agency, Based on the flushing arrangement scheme, identify all the equipments for which by-pass arrangement is to be carried out.
- 1.2.3.12.5 Study the site location & layout of the equipment, marking, cutting and shifting the fabricated pipe spools to the location and erection of the spools as per approved by-pass arrangement layout. Fit up and welding of the by-pass pipes using GTAW/SMAW.
- 1.2.3.12.6 All the piping material required for by pass arrangement will be issued by BHEL/NPCIL on free issue basis. All the consumables including welding consumables required for erection of temporary piping is under the contractor's scope of work.
- 1.2.3.12.7 Even though the piping is temporary the spools will be subjected to operating pressures and temperatures, in view of this all the welding related to temporary piping shall be carried out by qualified welders as per the applicable WPS.
- 1.2.3.12.8 In case of requirement for any pipe supports required for supporting the temporary piping, the same is included in the scope of work. (Note: Payment for supports for temporary piping will be paid in the relevant BOQ item).
- 1.2.3.12.9 Valves if required for erection of temporary piping will be issued on free issue basis. The same shall be deposited back with BHEL/NPCIL upon completion of flushing.
- 1.2.3.12.10 Temporary piping ranges from Dia 25NB to 500NB and thickness of standard or heavy wall thickness. For fabrication of the big bore piping care shall be taken and thorough study shall be done so that shifting of material inside the building shall not become difficult.
- 1.2.3.12.11 On completion of flushing activities, clearance shall be obtained from BHEL/NPCIL for dismantling of the temporary piping.
- 1.2.3.12.12 Cutting the temporary piping, handling, shifting outside the building and handing over the material to BHEL/NPCIL stores.
- 1.2.3.12.13 After completion of flushing temporary piping shall be normalized with the permanent piping (Note: payment for permanent piping will be measured in the relevant BOQ item).
- 1.2.3.13 **DRILLING, FIXING OF ANCHOR FASTENERS (USING HAMMER DRILLING/DIAMOND CORE CUTTING DRILL BITS) AND CORE CUTTING OF CIVIL STRUCTURES**
- 1.2.3.13.1 Pipe supports and various metal structures inside Reactor building and other Reactor auxiliary buildings are normally mounted using the support plates pre-embedded in the concrete. Wherever such embedded parts are not available, the base plates are to be anchored using Hilti anchor bolts as per approved drawings.
- 1.2.3.13.2 Hilti make HSL - 3G (heavy duty anchors) and HDA-T (under cut anchors) are mainly used to mount the pipe supports and other metal structures in Reactor building & Reactor aux. building.

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- 1.2.3.13.3 Also, during course of contract, due to issue of any DCN/ECN/FCN there may be requirement for making additional openings in the RCC walls / floors to accommodate the pipelines, tubes, structures etc. These openings (holes) may be carried out using core cutting process, scope of work includes carrying out drilling of holes in the RCC wall / floor using core cutting process to required diameter and the depth based on the thickness of the wall.
- 1.2.3.13.4 Location & type of anchor bolts will be provided in the working drawing. Contractor shall identify marking of location of anchor, drilling, fixing of anchor with EPs as per WDs, torque tightening using wrench as recommended by the manufacturer. Scope includes erection of scaffolding at various elevation & levels, providing cooling arrangement during drilling, collection of debris and disposal.
- 1.2.3.14 **HANDLING AND TRANSPORTATION OF MISCELLANEOUS ITEMS:**
- 1.2.3.14.1 During execution of work, there may be some requirement for movement of certain material / items/ equipment from one location to other location as instructed by the engineer other than items specified in respective BOQ items. Prior approval of ENC is required for operating this item.
- 1.2.3.14.2 Scope of work includes handling and shifting of material within the plant site. Maximum weight of equipment/ material envisaged to be shifted as a single unit will be less than 20MT.
- 1.2.3.14.3 Collecting material issue voucher (MIV) / any other relevant document required from BHEL/NPCIL, receipt of material from BHEL/NPCIL stores/other location specified by Engineer and delivering the material to the desired location within the plant site.
- 1.2.3.14.4 Arrangement of all necessary material handling equipments such as cranes, trailers, trucks, manpower, slings etc for loading and unloading is covered in the scope of contractor. All the material handling equipment shall be provided with valid load test certificates.
- 1.2.3.14.5 Rate of this item includes all man power, including coverage of safety personnel required along with other equipments, tools & tackles.
- 1.2.3.15 **PASSIVATION OF STAINLESS-STEEL COMPONENTS**
- 1.2.3.15.1 In case of any surface contamination on SS piping and liner, the same shall be rectified by carrying out passivation with due approval of BHEL.
- 1.2.3.15.2 If passivation is to be carried out inside the plant premises, contractor shall arrange required tanks, chemicals, consumables, manpower, tool/tackles, cleaning agents etc. and complete the work including checking and removal of contamination within quoted rate. If the passivation is not carried out inside plant premises due to various reasons. The contractor has to carry out same at outside, where the facility is available in nearby location. The cost involved for transportation, passivation cost shall be borne by the agency. No extra payment shall be allowed in this regard.

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- 1.2.3.15.3 Care shall be taken while handling of acids and other hazardous chemical. Also, the disposal of acids and other chemicals shall be done by following guidelines issued by statutory authorities.
- 1.2.3.15.4 Erection of scaffolding for carrying out passivation is in the scope of contractor. Only aluminum scaffolding shall be used in critical and SS lined area.
- 1.2.3.15.5 Pre-cleaning shall be carried on the surface to be passivated. This is to remove the grease, oil, soil, grit and other fabrication process marks etc. Cleaning of components / surface thoroughly using DM water. Cleaning can also be done using alkaline cleaning, which is used to remove oily, semi solid and solid contaminants and metal.
- 1.2.3.15.6 Drying of the components / surface after DM water wash shall be done using oil free compressed air, required air compressor and the hoses for carrying out the job shall be arranged by the contractor.
- 1.2.3.15.7 Contractor shall prepare, approve and submit procedure for acceptance of Engineer, as per applicable standard. The procedure shall also address the pre cleaning, methodology for passivation, post cleaning and testing.
- 1.2.3.16 **NICKEL GASKET REPLACEMENT**
- 1.2.3.16.1 A few high-pressure filters are provided with Nickel gasket, these filters are transported with temporary gasket. This gasket shall be replaced before taking the filter into commissioning / service.
- 1.2.3.16.2 Filters are located in the various buildings such as reactor building and reactor auxiliary buildings, at different locations and elevations. These filters are located in congested areas. Concrete hatches are to be handled for accessing & opening the filter covers.
- 1.2.3.16.3 These filters consist of a filtering medium such as titanium sorbent in granular form. Filtering medium shall be loaded into the filter before the filters are taken into service.
- 1.2.3.16.4 The scope of work to be performed by the contractor is specified below,
- Scope includes replacement of gaskets of the filters in the installed location which includes removal of hatch covers, filter covers.
 - Arranging required tools and tackles for lifting the hatch. The head room available for lifting the hatch is very less, where usual chain pulley block may not be accommodated. Special tools such as button jack with hydraulic power jacks and other suitable custom-made lifting tools are to be arranged for lifting the hatch from position.
 - Chipping of concrete if required shall be carried out for clearing the recess between the cover and the opening.
 - Once hatch is lifted, the same shall be shifted suitably to access the filter. Cleaning the filter area to unscrew the studs.
 - Providing the hydraulic power pack to unscrew the filter studs. Taking the stud length initial readings. Unscrew the studs as per the sequence, by applying the required torque using hydraulic torque wrench.

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- f. Remove all the studs, clean the studs thoroughly using acetone, preserve the studs in safe place till the re-assembly. Match mark the cover position, lift the filter cover to the required height and support the cover with temporary supports.
- g. Provide proper illumination with 24 volts power supply.
- h. Inspection of filter inside area, for any kind of foreign material or any deviations. Any deviations may be recorded and corrective actions may be taken as per the BHEL/NPCIL instructions.
- i. Handling, shifting of filtering medium (sorbent) from BHEL/NPCIL stores to the required location using bags of required size and quantity. Load the sorbent in the filter as per the guidelines, measure the level of the sorbent and cross check with the drawing requirement. Sorbent loading shall be done till the required level mentioned in the drawing is achieved. Once the required level is achieved report shall be prepared and submitted to for acceptance.
- j. Clean the gasket seating area & threaded area thoroughly using acetone, also clean the nickel gasket using acetone and inspect the gasket for any dents or deviations. Also dimensions of the gaskets shall be cross checked with the radius of the gasket grooves on the filter. Supply of acetone is under the scope of contractor.
- k. Place the gaskets in the position, and ensure the gasket is retained in position without disturbance during placing of cover, place the cover in position matching the initial markings. Apply lubricant on the threaded mating surfaces using mixture of graphite powder and the distilled water. (Note: supply of graphite powder and the distilled water is under the scope of contractor)
- l. Fasten the studs in position. Care shall be taken to prevent the damage to the threaded surfaces. Measure the stud length using depth micro meter. Fasten the nut with the studs, start tightening using the hydraulic torque wrench.
- m. Tightening shall be carried out in stages, over torque shall be prevented, also final torque required shall not be attained in single pass. After each pass of tightening in the sequence provided in the working drawing, stud length shall be checked using depth micrometer.
- n. Tightening passes shall be continued till the final torque is achieved and the stud elongation is cross checked with the initial measurement taken. Readings obtained in all stages / passes shall be recorded and reports shall be prepared and submitted for BHEL & NPCIL acceptance.
- o. Lift the hatch from the temporary position to the required location. Before placing the hatch back to the position, hatch seating area shall be cleaned thoroughly.
- p. Contractor shall note that gasket material may get changed during detailed design, however changing of gasket as specified above is covered in the scope of contractor irrespective of type of gasket.

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1.2.3.17 **MACHINING WORKS**

1.2.3.17.1 Machining work is required for the packing / alignment items such as wedge pair, guide plates, EP plates etc. Work includes all kinds of machining works such as

- Turning (ID / OD).
- threading
- milling
- drilling
- Boring
- Grinding
- Combination of above process.

1.2.3.17.2 Material will be issued by BHEL/NPCIL on free issue basis.

1.2.3.17.3 On request of engineer, contractor has to supply raw material confirming to stainless steel SA 276 - SS 321 Round bars/ Flat bars of various sizes and profiles and carbon steel SA 105 Round bars/ Flat bars of various sizes and profiles. All the raw material supplied shall be provided with necessary test certificates, BHEL/NPCIL reserve the right to take out the sample from the supplied raw material sent for testing for confirmation. Such testing shall be carried out in NPCIL approved laboratories, also the cost incurred in testing of the material is included in the contractor scope of work.

1.2.3.17.4 Detailed scope of work involved in machining of components of carbon steel and stainless is as given below.

- a) Preparation of necessary gate passes for taking out free issue material for machining activities. The same gate pass shall be surrendered after the material is brought back to the plant premises.
- b) Handling and shifting of material to the contractor's work shop / other location. Contractor may establish his work shop within the plant site or he may utilize the services of the local resources. If the job demands some special lathe / milling/ drilling process, it is the responsibility of the contractor to identify such facility and carry out the job done.
- c) Except threading all the machining process will be measured in the CC (Cubic centimeter) i.e. CC corresponding to the material removed from the raw material to make the finish product.
- d) Whereas threading will be paid in the MM-MM i.e. MM DIA X MM LENGTH of threading (Ex 25mm thread for a length of 50mm = 1250mm -mm).
- e) Threading involves combined process such as turning and threading. In such cases turning will be paid in CC and threading will be paid separately.
- f) In case any NDE such as DPT that is to be carried out on the finished product the same shall be carried out. However, payment for DPT will be paid in the relevant BOQ item.

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1.2.3.18 MISCELLANEOUS WORKS (MANPOWER)

- 1.2.3.18.1 As the nature of work consists of various operation-based works, for which contractor has to mobilize skilled, semi-skilled and unskilled manpower along with sufficient number of supervisors for successful completion of the work assigned based on the Engineer's instruction. Operation based works are works other than works covered under other BOQ items.
- 1.2.3.18.2 Manpower mobilized shall be fully equipped with necessary hand tools & PPEs such as measuring tools, grinding, cutting, welding, fastening etc.
- 1.2.3.18.3 Contractor shall provide supervising/drafting assistance for various miscellaneous activities (other than contractor scope of work) as instructed by BHEL/NPCIL Engineer for carrying out site dimensional measurements, as built checking, AutoCAD drafting etc. A Qualified supervisor (Qualification given below) Performing such activity for 9 Hrs a day is considered as one operation.
- 1.2.3.18.4 Contractor shall provide qualified / certified skilled/semi-skilled/un-skilled as instructed by ENC for carrying out miscellaneous works, providing office assistance, fabrication, machining activities at engineer shop etc.,. Performing such activity for 9 Hrs a day is considered as one operation.
- 1.2.3.18.5 All the above personnel shall be provided with all safety PPEs like safety shoes, safety helmets, measuring tapes and portable long range LED rechargeable flash light (for site visits and measurements) etc., Contractor shall ensure these personnel have height passes with medical certificate, fitness certificate before employed. BHEL/NPCIL Engineer shall be part of interview/ skill test for the above personnel to find the suitability before giving clearance. During the execution of jobs also, they may be continuously evaluated and may have to be changed if the skill is found not suitable at any stage.
- 1.2.3.18.6 Normal day of work for these persons taken against this BOQ will be 9 hrs. Including the breaks for Lunch, tea etc.
- 1.2.3.18.7 All man power supplied shall be covered by suitable insurance policies and BHEL will not entertain any claims towards this at any stages. Contractor shall make their own arrangements for the housing, transportation, canteen facilities, medical facilities etc. for these persons also just like their other employees. BHEL will not entertain any claims towards this at any stages. Suitable transportation arrangements for the staff between Plants main security gate to working area needs to be provided by the contractor compulsorily.

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Sl.No	Category	Qualification and Experience required
1	Mechanical Supervisor/AutoCAD operator	DME (Mechanical) Persons with 3 years' experience in any mechanical construction project will be preferred. Should be proficient in MS office and AutoCAD drafting. 3D drafting and isometric drawings preparation preferable.
2	Skilled person	ITI qualified with 2 year experience.
3	Semiskilled	Based on the skill qualification certification.
4	Unskilled	Based on in-house training certification

1.2.3.19 **GROUTING / DRY PACKING OF EQUIPMENT AND PIPE SUPPORTS:**

- 1.2.3.19.1 Grouting / Dry Packing as required shall be provided as indicated in the drawings. The proportion of grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage.
- 1.2.3.19.2 Concrete surfaces to be grouted / dry packed shall be thoroughly roughened and cleaned off all foreign matter and laitance. Anchor bolts, anchor bolt holes and the bottom of equipment and column base plates shall be cleaned and made free from oil, grease, dirt and loose material.
- 1.2.3.19.3 Prior to grouting/ dry packing, the hardened concrete surfaces shall be saturated with water. Water in anchor bolt holes shall be removed before grouting is started.
- 1.2.3.19.4 Forms around base plates shall be reasonably tight to prevent leakage of grout/ dry pack. Adequate clearance shall be provided between formwork and base plate, to permit grout/ dry pack to be worked properly into place.
- 1.2.3.19.5 Grouting, once started, shall be done expeditiously and continuously to prevent segregation, bleeding and within the initial setting time. Grout shall be worked from one side to the other, to prevent, entrapment of air.
- 1.2.3.19.6 Forms and shims shall not be removed and the anchor bolts shall not be tightened for at least 24 hours after placing the grout. After the removal of forms and peripheral shims all the edges of the foundation shall be finished smooth to allow drainage away from the base.
- 1.2.3.19.7 Interconnecting piping and machinery shall not be attached to the machinery before anchor bolts are tightened. It is desirable to make these connections at least after a

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minimum of seven days from the date of grouting. During this period, the grout shall be properly cured.

1.2.3.19.8 The dry pack shall consist of 1: 2.5 (Cement, Sand), sand passing through No. 16 sieve. Only enough water shall be added to produce a mortar, which will stick together when moulded into a ball by a slight pressure of hand and will not extrude water but will leave the hands just damp. Dry pack material shall be placed and packed in layers having a compacted thickness of about 10mm. Each layer shall be solidly compacted over the entire surface by use of hardwood stick and hammer.

1.2.3.19.9 The type of grout and its composition is given below.

a) Normal Grout

The Contractor shall supply and place normal grout consisting of an approved mixture of cement, normal fine aggregate, water, admixture and when specified by the Engineer, a non-shrink agent. Normal grout shall be placed as shown on the drawings or specified by the Engineer. Grouting through holes in base plates shall be made by pressure grouting. The pressure to be used for grouting shall be as directed by the Engineer.

The grout proportions shall be as follows unless it is specified in the drawing

Mix Proportion	W/C Ratio(max)
Mix 11 Cement Sand grout with anti-shrink compound	0.44
Mix 12 Cement Sand grout with anti-shrink compound	0.44
Mix 112 cement sand with 6mm down stone chips and anti-shrink compound	0.44

The W/C ratio shall be as per the manufacturer's recommendation and in no case shall exceed the values specified above.

b) Special Grout

The Contractor shall supply and place heavy grout consisting of approved high strength cementations ready mix non-shrink grout 'Conbextra GP-2' (M/S Fosroc make) or equivalent shall be provided at equipment bases, areas specified in the drawing.

The grout shall be prepared only to the extent it can be used within the specified pot life by the manufacturer. Any leftover grout or grouts not consumed within the pot life shall not be used and shall be discarded. The shelf life of the grout shall also be checked before they are used. Expired date grouts shall not be used under any circumstances.

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The grouts shall be chloride free and shall be used following strictly the manufacturer's specification.

c) Heavy Grout

The Contractor shall supply and place heavy grout consisting of an approved mixture of cement, heavy fine aggregate, water, and when specified by the Engineer, a water reducing agent and a non-shrink agent. The heavy grout / dry pack of density not less than 3200 kg/cum shall be provided at equipment bases, areas specified in the drawing.

1.2.3.20 **GENERAL FABRICATION AND ERECTION REQUIREMENTS:**

- 1.2.3.20.1 All piping, equipment etc. shall be erected and joined or welded, utilizing materials in accordance with the working documentation supplied by the engineer.
- 1.2.3.20.2 Pipeline shall be made with the minimum feasible number of joints. The contractor shall shop fabricate the sub-assemblies of piping, supports etc., to the maximum extent feasible.
- 1.2.3.20.3 All machined surfaces shall be protected from dirt and mechanical damage. All threaded connections shall be either capped or have threaded plugs inserted until the associated equipment has been installed. No liquids of any kind, whether for cleaning, testing or other reasons, shall be admitted to the pipe lines or the equipment except when authorized by the Engineer.
- 1.2.3.20.4 Loading and unloading of materials and equipment shall be done by hoisting or skidding so as to avoid shock or damage. Under no circumstance's materials shall be dropped. Pipe handled on skid ways shall not be skidded or rolled against other pipe.
- 1.2.3.20.5 The contractor shall visually examine all materials being erected or being used in the fabrication and shall report any defects to the Engineer. Any repair of materials shall be as per approval of the Engineer. Any material not conforming to the specification and subsequently rejected should be suitably identified, stocked and disposed off as per the instructions of the engineer.
- 1.2.3.20.6 The areas from which temporary attachments have been removed from equipment shall be dressed smooth and shall be examined by liquid penetrant method. Defects, if any, shall be rectified after due concurrence from Engineer and the material shall be reinspected to ensure that the defects have been removed. If weld repairs are necessary, they shall be made using qualified welding procedures by qualified welders and shall be examined by a liquid penetrant method, or by radiographic examination.
- 1.2.3.20.7 To avoid the possibility of damage all gaskets, diaphragms, seals etc. shall be removed from valves and other equipment, properly identified, stored and reassembled by the contractor under supervision of Engineer during rectification of defects by welding
- 1.2.3.20.8 Gouging and gas cutting operation shall be done by qualified personnel. All material in the surrounding area should be suitably protected during welding, gouging and gas cutting operation.

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- 1.2.3.20.9 Adequate care shall be taken during welding of valves. Valve manufacturer's instructions, if any, shall be followed in this regard. Contractor shall take due care and adopt proper welding sequence to avoid distortions of valve seat, body and related components. The valves shall be tested in valve testing facility provided by BHEL. Any repair work required on installed valve shall be carried out by the contractor to limit the seat leakage rates to those specified by valve manufacturer. Generally, valves should be welded in open position and heat input kept to the minimum.
- 1.2.3.20.10 Utmost care shall be taken while carrying out welding job on equipment nozzle, particularly heat exchangers etc. so that no weld splatter falls inside the equipment.
- 1.2.3.20.11 The contractor will take adequate care to prevent damage to pipe penetrations during storage, handling and erection. The penetration shall be stored with their original shipping frame and protective arrangement and shall be brought to site as the last item, just prior to their incorporation in the system.
- 1.2.3.20.12 Many room (floor & walls) are provided with stainless steel & carbon steel liner, the contractor shall take extreme care while erecting equipment and piping to avoid damage to the room liner. The scaffolding used in the area shall be made of aluminum and other areas CS scaffoldings shall have rubber bushing to avoid scratch & dents.
- 1.2.3.21 **TIGHTENING OF BOLTS:**
- 1.2.3.21.1 All threads of bolts and nuts shall be cleaned by suitable means so as to be free from any foreign materials and suitably approved lubricant whenever specified shall be used prior to tightening of bolts.
- 1.2.3.21.2 All bolts shall be engaged so that there is visible evidence of complete threading through the nut or threaded attachment. At least two threads on bolt should project beyond nut.
- 1.2.3.21.3 In bolting of gasket-flanged joints, proper sequence shall be followed to ensure uniform tightness.
- 1.2.3.21.4 Calibrated Torque Wrenches (both mechanical and hydraulic) shall be used for tightening of bolts to ensure controlled tightening. Torque values for various sizes of bolts for tightening shall be as per specification / drawings.
- 1.2.3.22 **ELECTRODE STORAGE, CONTROL AND MONITORING:**
- Electrodes and filler wire of various specification, make, type, sizes will be supplied along with equipment and pipelines as free issue for carrying out welding of piping and equipment as specified in the WDs. The scope of work to be done by the contractor is elaborated below
- 1.2.3.22.1 IMIR: The electrode and filler wire received shall be inspected, accepted and report shall be made. Deficiency if any shall be intimated to engineer.
- 1.2.3.22.2 Storage: The contractor shall receive electrodes and filler wire and store them in a closed room with controlled temperature & humidity. The temperature of room shall be

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maintained not lower than +20°C and not more than 50°C. The relative humidity of room should not exceed 50%. Electrodes for different equipment and piping shall be identified and kept segregated till they are consumed.

1.2.3.22.3 Electrode baking: The electrode of different type needs to be baked at different temperature. The contractor shall have baking oven of heating capacity not lower than 400°C. The baked electrode should be stored at site in a transfer oven having temperature range 150°C to 200°C. Electrode for consumption of one shift only shall be sent to site in portable oven having heating range of 100°C and above. Electrode should never be issued to site without ovens.

1.2.3.22.4 Electrode control and calculation: Record of quantity of electrode & filler wire received by the contractor shall be updated on daily basis with details such as item no, system (KKS code), type, size, material, quantity. The status of issue to field, consumption and quantity returned shall be updated in weekly basis. Free issue electrode & filler wire shall be used only for welding of equipment / piping as supplied & issued to contractor. Using of welding consumables without approval of engineer to other system / piping is strictly prohibited. Contractor shall submit the status of welding consumables received, consumed, stock available once in fortnight.

1.2.3.22.5 Monitoring: Contractor shall employ experienced technical person as store keeper to monitor electrode receipt, storage, handling and control. The records should be maintained online with the help of construction management system.

1.2.3.22.6 Welding consumable storage, condition of storage room, records of issue are subject to periodical audit by the engineer or his authorized representative.

1.2.3.23 **DISCREPANCIES AND FIELD CHANGES:**

1.2.3.23.1 Any discrepancies, contradictions, or omissions from drawings, specifications or other documents or any doubt arising as to the meaning or intent of any part thereof, shall be referred to the Engineer for clarifications. All dimensions shown on the drawings which are related to installed equipment or pertinent embedded parts shall be verified by the contractor by field measurement before the fabrication of relevant pipelines is started.

1.2.3.23.2 The required dimensions of closing pieces of piping as indicated on the detailed drawings must be established by direct field measurements.

1.2.3.23.3 Whenever the contractor is unable to comply with the Engineer's requirements, whether it is dimensional or technical, or whenever field changes are inevitable for any reason, the contractor must obtain the appropriate authorization from the engineer. In case any field changes are to be carried out, the same proposal shall be submitted in the prescribed/ established formats.

1.2.3.24 **REFERENCE DRAWING AND DOCUMENTS:**

1.2.3.24.1 Erection of equipments and piping shall be done as per working drawing supplied progressively during installation phase. The working documents (set of drawings and

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documents) will generally contain necessary information for erection and testing of pipeline and equipment. To get an idea of the nature of the documents on the basis of which the erection would be done, sample working documents of piping, piping support erection, equipment erection

- 1.2.3.24.2 The documents and drawings indicated above are only for reference and are for guidance of contractor. The work shall be executed as per drawings and documents issued by engineer for the purpose.

1.2.3.25 **HOUSEKEEPING & CLEANLINESS:**

- 1.2.3.25.1 Contractor shall employ separate personnel for cleaning & up keeping of working area where work is undertaken by the contractor. Cleaning shall be done on day to day basis. All housekeeping personnel shall be provided with separate uniform.

- 1.2.3.25.2 In case of work taken up in multi front like different building and elevation, the number of housekeeping personnel shall be suitably augmented to ensure up-keeping on day to day basis.

- 1.2.3.25.3 The contractor shall thoroughly check and remove the extraneous materials, if any, like electrode stubs, bolts/nuts, etc. left behind in the pipelines and surrounding area.

- 1.2.3.25.4 The contractor shall engage adequate vacuum cleaners at locations where welding & grinding is performed.

- 1.2.3.25.5 The waste collected shall be stored in closed container outside the building on daily basis at identified location and to be removed & disposed on weekly basis / as on when required.

- 1.2.3.25.6 The contractor shall provide safety gear & gadgets to housekeeping personnel. The hand tools used shall not be stored inside the building.

1.2.3.26 **CONFIDENTIAL INFORMATION:**

- 1.2.3.26.1 The drawings, specifications, proto-type, samples and such other information furnished to the contractor relating to the supply/works, sub-systems/equipments etc. are to be treated as confidential, which shall be held by the contractor in confidence and shall not be divulged to any third party without the prior written consent of the engineer. The contractor, therefore, binds himself, his successors, heirs, executors, administrators, employees and the permitted assignees or such other persons or agents directly or indirectly concerned with the works/supply to the confidential nature of the drawings, specifications, proto-type samples etc. It is a further condition of the contract that the contractor shall not, without prior written permission from the Engineer, transmit, transfer, exchange, gift or communicate any such confidential information and also the component, sub-assembly, products, by-products, non-conforming/rejected equipment/ components, etc. to any third party.

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1.2.3.27 **PATENTS, PATTERN, SAMPLES AND MODELS AND PATENT RIGHT INDEMNIFICATION:**

1.2.3.27.1 All specifications, drawings, documents and other items furnished to the contractor by the Engineer are intended to be complementary and to provide for and comprise everything necessary for the completion of works/supply and are the property of the Engineer. These are not to be used for any work or purpose other than those for which these have been provided and shall be returned to the Engineer immediately on completion of work/supply in good condition.

1.2.3.27.2 If, during the process of execution of the contract, any improvement, refinement or technical changes and modifications are affected by the Contractor, such changes shall not affect the title to the property of the engineer and the information, specifications, drawings, etc. including the improvement/modifications affected by the Engineer. The Engineer shall also have the absolute right to assign, transfer, sublet, use and transmit all such information and details to the Engineer's consultants. Contractor shall not have any claim or rights whatsoever in respect of the Engineer's drawings, specification, patents, proto-types etc. even where improvement refinement, modifications etc. were affected by the contractor.

1.2.3.28 **RECORDS AND REPORTS:**

1.2.3.28.1 The Contractor shall maintain records pertaining to the storage, fabrication, welding, erection, alignment, inspection and testing work in compliance with all drawings and technical requirements. The records shall be in a proper format as indicated by the Engineer. The Contractor shall submit the copies of such-records to the Engineer within 7 days from completion of any particular work, and prior to submitting bill for progressive payments. The report concerning welding, alignment of the equipments and flanges are included in this category. For material supplied by contractor, the contractor shall forward one copy of test certificate to the Engineer pertaining to the origin and specification of material. The Engineer shall need certain records for verification viz. weld inspection report, stress relieving report, consumable certificate, etc.,. The Contractor shall establish a system to facilitate easy traceability of all such records.

1.2.3.28.2 The contractor shall submit on weekly basis, to the engineer following reports indicating the details like system wise progress, fabrication/erection progress, system testing status, QA activities, etc.

- a) Equipment erection progress report
- b) Piping erection progress report
- c) General statement of activities
- d) Welders performance & qualification records
- e) Weekly report on items on critical paths

1.2.3.28.3 In addition to above, the following reports shall be submitted to the engineer.

- i) Daily, weekly, fortnightly and monthly progress reports
- ii) Monthly planning report

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iii) Three- and Six-months rolling schedules

1.2.3.28.4 All reports shall be statistical and on tabulated form indicated by the Engineer.

1.2.3.29 **REMOVAL OF CAPS:**

1.2.3.29.1 Removal of caps and other closures from all equipment nozzles supplied with temporary caps, irrespective whether equipment is erected by the contractor or the Engineer, is included in contractor's scope of work in case the piping to be connected by the contractor. The removal of caps shall be done by grinding or sawing off as approved by Engineer on case to case basis. Any damage to the equipment during the process of removal of the caps shall have to be made good by the contractor at his own cost.

1.2.3.30 **ARGON GAS SUPPLY STATION FOR WELDING:**

1.2.3.30.1 Welding of piping covered in this tender such as stainless steel and carbon steel shall be performed using GTAW process for root & stabilizing pass. In some cases, all passes are welded using GTAW process. The reactor auxiliary building is having 10 floors and reactor building is having entry only through three air locks. Movement of argon cylinders on day to day basis is one of the most cumbersome & tedious process. Storage of cylinders in reactor building is not permitted. Large number of contractor manpower to be engaged for movement of cylinders for welding which is unproductive. It will be advantages to supply argon gas from common points to all locations of reactor building if possible, reactor auxiliary building. To make the Argon gas supply station, contractor may establish piping & tubing network with adequate control. The contractor shall consider such proposal and shall be prepared and submitted to BHEL & NPCIL for concurrence and approval.

1.2.3.31 **CONSTRUCTION COMPLETION**

1.2.3.31.1 The contractor's work shall be considered completed when the equipment and piping systems are installed meeting all requirements spelt out in drawings and specifications, have passed all examination, inspection and tests requirements described in technical specifications and working drawings. The contractor shall submit Construction Completion Certificate (CCC) in specified format attaching all relevant documents, to the Engineer for acceptance. Any deficiency revealed during testing or commissioning of the systems, pertaining to the portion of works executed by the contractor, shall be rectified expeditiously in consultation with the Engineer. Final completion certificate will be issued only after acceptance of all CCCs and after other provisions of general contract conditions are duly met.

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK – TECHNICAL SPECIFICATION.

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VOLUME IA PART – I CHAPTER – III

1.3 FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1	PART I			
1.3.1.1	ESTABLISHMENT			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
1.3.1.1.1.1	Open space for office	Yes		Free
1.3.1.1.1.2	Open space for storage	Yes		Free
1.3.1.1.1.3	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
1.3.1.1.1.4	Bidder's all office equipment, office / store / canteen/Consumables.		Yes	
1.3.1.1.1.5	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
1.3.1.1.1.6	Fire fighting equipment like buckets, extinguishers Etc		Yes	
1.3.1.1.1.7	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.1.2	FOR LIVING PURPOSES OF THE BIDDER			
1.3.1.1.2.1	Living accommodation		Yes	
1.3.1.2	ELECTRICITY			Chargeable Basis
1.3.1.2.1	Electricity For construction Purposes			Prevailing rate of TANGEDCO
1.3.1.2.1.1	Single point source for erection work and one more point for contractor office & stores	Yes		
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	

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1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Demobilization of the facilities after completion of works		Yes	
1.3.1.3	WATER SUPPLY			
1.3.1.3.1	For construction purposes		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc		Yes	
1.3.1.4	LIGHTING			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.5	COMMUNICATION FACILITIES for site operations of the bidder			
1.3.1.5.1	Telephone, Fax, internet, internet, email etc (min 2 Nos of PC & Printer) – 2 Data entry operator with computer knowledge		Yes	
1.3.1.6	COMPRESSED AIR SUPPLY			

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1.3.1.6.1	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc		Yes	
1.3.1.6.2	Installation of above system and operation & maintenance of the same		Yes	
1.3.1.6.3	Supply of the all the consumables for the above system during the contract period		Yes	

1.3.2	PART II			
1.3.2.1	ERECTION FACILITIES			
1.3.2.1.1	Engineering works for construction	Yes		In consultation with BHEL
1.3.2.1.2	Providing the erection drawings/ documents for all the equipment covered under this scope	Yes		
1.3.2.1.3	Drawings for construction methods		Yes	
1.3.2.1.4	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	
1.3.2.1.5	Shipping lists etc for reference and planning the activities	Yes		
1.3.2.1.6	Grit blasting & Painting shed	Yes		Equipments for grit blasting & Painting in Bidder scope.
1.3.2.1.7	Valve testing facility	Yes		Shifting, handling of valves and operation in bidders scope
1.3.2.1.8	Coating Application Methods & Procedures	Yes		
1.3.2.1.9	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
1.3.2.1.10	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	

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1.3.2.1.11	Weekly erection schedules based on SI No 1.3.2.1.9		Yes	
1.3.2.1.12	Daily erection / work plan based on SI No 1.3.2.1.11		Yes	
1.3.2.1.13	Preparation of preassembly bay		Yes	
1.3.2.1.14	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	

1.3.3 LAND FOR SITE OFFICE

- 1.3.3.1 Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, storage area, storage shed, work shop and RT source storage pits etc. inside the plant area. All the arrangements will be subject to the approval of Engineer prior to setting up of such facility.
- 1.3.3.2 The contractor's office shall be semi-permanent structure and built with standard construction materials. No make shift structures are permitted. The facilities to be built by the contractor shall be aesthetically pleasing and shall match with the general surrounding of KKNPP site.
- 1.3.3.3 BHEL shall not provide to the contractor any residential accommodation to any of their staff and the contractor has to make their own arrangements.
- 1.3.3.4 Location and area requirement for office / storage sheds shall be discussed and mutually agreed to.

1.3.4 ELECTRICITY:

- 1.3.4.1 Construction power will be provided to the contractor at one point from BHEL LT Panel located in Reactor building area and one more point for contractor office & stores from the nearest BHEL panel located in BHEL storage yard on chargeable basis at the applicable rate of TANGEDCO under LT tariff. The present LT tariff VI rate of TANGEDCO is
- a) Consumption charges: The prevailing rate of TANGEDCO is Rs.12.00 per unit
 - b) Fixed MD charges as applicable per month
 - c) Electricity Tax on total amount
- 1.3.4.2 The TANGEDCO tariff and tax may vary from time to time. Digital Energy meter capable of recording KVA, KWh & Maximum demand shall be installed by the contractor on the distribution panel for measuring the consumption. Any dispute regarding consumption, the BHEL engineer's decision is final. The contractor shall

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make their own arrangement for further distribution to the site of work using armored Power cable and MCB distribution boards.

- 1.3.4.3 Contractor to maintain log sheet with BHEL engineering in charge signature for weekly/ monthly power consumption and healthiness of ELCB.
- 1.3.4.4 Provision of distribution of electrical power from the given points to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State/ BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
- 1.3.4.5 BHEL is not responsible for any loss or damage to the contractor 's equipment as a result of variations in voltage / frequency or interruptions in power supply.
- 1.3.4.6 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at their cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
- 1.3.4.7 The contractor shall make own arrangements for deployment of required capacity DG sets for Grit blasting & Painting work of already laid sea water Pipe lines, where ever the Power supply extension may not feasible from the Single Point Power source due to Plant construction activities & Distance restriction.
- 1.3.4.8 As there are bound to be interruptions in regular power supply, power cut/load shedding in any construction sites, contractor should make their own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown /failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.
- 1.3.4.9 All electrical installations/works shall be carried out by qualified electricians under supervision GOVT approved electrical contractor as per IE Guide lines and Safety procedure of NPCIL. The same shall be maintained properly and regular periodic maintenance shall be carried out to ensure healthiness of electrical system.
- 1.3.4.10 All cabling and installations shall be subject to the approval of the Engineer/Safety Engineer and shall comply in all respects to the appropriate statutory requirements given in the following.
 - i. Indian Electricity Act 1910 (as amended/latest)
 - ii. Electricity Supply Act 1910 (as amended/latest)
 - iii. Indian Electricity Rules 1956 (as amended/latest)
 - iv. TNEB regulations (latest)
- 1.3.4.11 For this purpose, the Contractor shall provide full specifications of the equipments and the layout drawings. Approval of the Engineer does not relieve the Contractor's responsibility from complying with any or all other conditions laid down in this section.

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1.3.4.12 DOMESTIC POWER SUPPLY FOR LABOUR CAMP

- i. TNEB/TANGEDCO established LT Power distribution arrangement in the labour camp area.
- ii. The Contractor shall make his own arrangements to obtain and distribute the power supply from TNEB/TANGEDCO for the labour colony and other domestic purposes. All internal wiring shall be done as per the requirements of relevant Indian standards. Any duty, deposit involved in getting the Electricity for labour colony shall be borne by the bidder.

1.3.5 CONSTRUCTION WATER

- 1.3.5.1 BHEL/NPCIL will not be able to supply water at plant site to the contractor. The Contractor shall make his own arrangements to meet the desired quality and quantity of construction water demand at his own cost from outside. Bore well is not permitted inside the plant area.
- 1.3.5.2 Contractor shall ensure quality of water used for construction as per relevant standards and shall submit periodic test certificates from NPCIL approved laboratories for the same. Contractor shall lay and maintain water supply lines to their construction site.
- 1.3.5.3 Contractor to construct suitable storage tanks to meet at least four day's water requirements at site. The contractor shall provide necessary number and capacity of electrical / diesel operated high lift pumps to ensure supply of water at the highest point of the structure.
- 1.3.5.4 The quality of the water shall meet the domestic purpose as per relevant IS standards. Periodical checking shall be done to ensure the quality of water being supplied.

1.3.6 DRINKING WATER

- 1.3.6.1 Drinking water shall be arranged by the Contractor at their cost from outside of KKNPP.

1.3.7 LIGHTING FACILITY

- 1.3.7.1 Adequate lighting facility and illumination level in line of Rule - 11 of Atomic Energy (Factories) Rules 1996 for buildings and outside area such as flood light, hand lights and area lighting shall be provided by the contractor at his own cost at the site of erection, at the storage of his materials and equipment and at temporary access roads within the working area. The contractor shall obtain the approval of the Engineer for the lighting arrangement prior to installation. The lighting fixtures used shall be of good quality with all its systems and control gears working in good condition.
- 1.3.7.2 The lighting network to be established during the construction phase shall be of semi - permanent nature using pre-fabricated channels, conduiting or cleating of cables etc. Hanging or indiscriminate looping of lighting cables is not acceptable and Engineer reserves the right to disconnect any lighting network carried out in an unsafe and untidy manner. Any recommendations given by the Engineer in this regard to improve the

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safety and aesthetic appearance of the electrical installations shall be binding on the Contractor.

- 1.3.7.3 All the electrical safety requirements stipulated at site from time to time shall be adhered and complied in order to ensure complete electrical safety of all installations as well as operation, control and protection etc.,
- 1.3.7.4 Contractors are encouraged to explore the possibility of using renewable and green energy sources such as solar energy and LED lighting in their premises at site and labor camp.

1.3.8 LAND FOR STAFF AND LABOUR CAMP

- 1.3.8.1 Land will be given, if available, by the Corporation for the Contractor's colony. Land will be made available for the period of Contract. The Contractor shall make his own arrangement for water supply, electric supply, sanitation, access road and general cleanliness of his colony. All these amenities shall be got approved by the Engineer-in-Charge of BHEL and NPCIL prior to construction of the camp. The Contractor shall not permit any of his personnel to maintain any living quarters within the Corporation's land other than the land allotted for colony. In case the land allotted for setting up the camp / colony is on lease, the contractor shall pay the appropriate municipal taxes / duties as applicable.
- 1.3.8.2 In respect of any land allotted to the Contractor for purposes of or in connection with the Contract, the Contractor shall be a licensee subject to the following and such other terms and conditions as may be imposed by licensor:
 - i) that he shall pay a nominal license fee of Rs..1 per hectare per year or part of a year for use and occupation, in respect of each and every separate area of land allotted to him.
 - ii) that such use or occupation shall not confer any right of tenancy of the land to the Contractor.
 - iii) that the Contractor shall be liable to vacate the land on demand by the Engineer-in-Charge.
 - iv) that the Contractor shall have no right to any construction over this land without the written permission of the Engineer-in-Charge. In case, he is allowed to construct any structure he shall have to demolish and clear the same before handing over the completed work unless agreed to the contrary. On completion of work, the Contractor shall handover the land duly cleaned to the Engineer-in-Charge. Until and unless the Contractor has handed over the vacant possession of land allotted to him for the above purposes, the payment of his final bill shall not be made. The Contractor shall be made liable to pay at the rate of Rs. 5,000 per week as a penalty for the use and occupation of land beyond 6 months from the date of physical completion of work.
- 1.3.8.3 **In addition, the following Clause is applicable:**

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- i) The Land for labour camp provided by NPCIL is at a distance of 1.6KM (approx) from plant Main gate & out side the project area but within the the over all plant boundary.
- ii) Contractor has to construct the labour camp with all required facilities in line with NPCIL/GOVT guide lines. Labour camp shall have spacious labour living rooms with adequate ventilation, toilet & both room blocks, canteen, Medical centre, common recreation hall with TV & some indoor game arrangement.
- iii) Contractor shall maintain the labour camp in neat and clean condition till completion contract at his cost
- iv) The contractor has to connect sewage from his labour camp to this facility through associated sewer line provided with necessary intermediate inspection chambers at his own cost.
- v) After completion of works, contractor shall at his own cost promptly dismantle all structures to restore the land to the original condition and vacate the area.
- vi) The Contractor shall provide adequate facilities for medical aid and treatment for his staff and workers engaged on the Project, both at work site as well as at the camp.
- vii) Contractor may note that a lot of trees are planted in the Project area. It shall be the Contractor's responsibility to ensure the prevention of cutting/felling of plantations by the workers employed by him. The Contractor will be penalized as decided by Engineer if it is found that his labours / employees are responsible for cutting /felling of plantations.

1.3.9 **SECURITY OF CAMP:**

1.3.9.1 The following actions shall be taken by the Contractor to have adequate security and discipline at camp area:

- i) The contractor shall furnish a statement in every quarter showing the number of people permitted and occupying the area allotted by the Corporation.
- ii) The contractor shall control unlawful activities in the camp.
- iii) Contractor shall provide adequate security coverage and will be responsible for identification of people belonging to them and shall only allow people into the labour camp who are authorized by them.

1.3.10 **WATER FOR LABOUR CAMP**

1.3.10.1 BHEL/NPCIL will not be able to supply water to the contractor's labour camp. The contractor shall make his own arrangements to provide the same at his own cost. Borewell is not permitted in labour camp area. The quality and quantity of the water supplied at labour camp shall be as per WHO drinking standards.

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1.3.11 STATUTORY REQUIREMENTS

Kudankulam Nuclear Power Project is guided by Central government rules and regulations. Contractor shall comply all statutory regulations of State / Central Governments and NPCIL like Pradhan Mantri Rojgar Protsahan Yojana (PMRPY) scheme, Pradhan Mantri Garib Kalyan Yojana (PMGKY) scheme etc. Any guide lines / orders/notifications/ circulars issued by statutory body of both central /state governments and NPCIL from time to time is applicable for this contract.

1.3.12 FAIR WAGES

The bidders shall note that the minimum rates of remuneration to the various categories of workmen to be deployed under this contract shall not be less than the following:

- i. Higher of the minimum wages as declared by the Labour Authority of Centre/State from time to time for the respective category of workmen to be paid. The contractor shall pay to his workmen any increase in the minimum wages as notified from time to time during the period of contract.
- ii. The contractor has to provide free transport facility to his workmen.
- iii. Bonus as per the statutory requirements (at present @ 8.33% of the wages) shall be paid to the workers separately either once or twice in a year (as per present regulation). Wage ceiling for calculation of bonus is minimum wage for the scheduled employment, as per para 15 (i) or Rs 7000/- , whichever is higher. Any changes as per statutory requirement shall be complied with from time to time.
- iv. EPF shall be paid as per the statutory requirements for all the workers (at present @ 13.15% of the wages by limiting the maximum wages as Rs.15000/-, even for those whose wages is more than Rs. 15000/-). Contractor should mandatorily have EPF registration irrespective of number of workers to be engaged by him. Further, contractor has to ensure PF coverage to all his workers at KKNPP irrespective of their exemption as per rules. He shall ensure regularly depositing of EPF as per prevailing statutory norms for the workmen deployed for the subject work and proof of deposit shall be produced along with monthly R.A. bills for processing of the next R.A. bill. The contractor shall comply with all the existing/revised provisions of the employee's provident funds and miscellaneous provisions Act, 1952. The contractor should maintain record of statutory EPF amount deposited in the respective EPF accounts of his workers and submit the same with every RA Bill. Contractor is also required to submit EPF returns details of all workers employed in this contract in the prescribed forms 3A, 6A and 12A to the EPF authority with copy to the Engineer.
- v. Contractor shall make payments to the workmen only through Bank. For this purpose, the Contractor shall ensure that all the workers are having a bank account

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and if not, he shall facilitate the worker for opening of an account. In isolated cases, if it is not possible to make payments to any workers through Bank account, the approval of KKNPP Unit Head shall be obtained for making the payment by cash. In the event of cash payment to any contract workers, the same shall be witnessed by an official of NPCIL HR section duly authorized by the Head of HR group of KKNPP. Every month the Contractor shall submit documentary evidence (Bank statement of deposit of amount in each worker's bank account) to Engineer for verification, in the absence of which processing of next RA bill will not be done.

1.3.13 CONTRACTOR'S OBLIGATION ON COMPLETION:

On completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at their cost. In the event of their failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

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1.4 **T&Ps TO BE DEPLOYED BY CONTRACTOR for each package**

- 1.4.1 The following indicative list of major Tools & Plants (T&P) shall be arranged by the Contractor within the quoted rate for each unit for execution of the scope of works covered under this contract.

MAJOR T & P LIST		
S.no	Description of Equipment and machinery	Qty (nos.)
	<u>Material handling</u>	
1	Mobile crane (Up to 40MT)	1
2	Hydra 16 MT	2
3	Hydra 12 MT	2
4	Electric winch upto10T	4
5	Trailer 40ft , 20MT	1
6	Mini Truck capacity 7 MT	1
7	Mini Truck capacity 2MT	1
	<u>Rigging</u>	
8	BOW SHACKLE 75 MT/65/55MT	As required
9	D SHACKLE 50/25/10/5 MT	As required
10	Wire rope slings 3" DIA required length 63MT	As required
11	Wire rope slings 2" DIA 12METER LONG SLING 25MT	As required
12	Wire rope slings 1" DIA 12METER LONG SLING 10MT	As required
13	Chain pulley block (Upto 20 T)	As required
14	Hydraulic power packs for jacks	As required
15	Hydraulic jacks 100T	2
16	Hydraulic jacks 50T	4

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17	Hydraulic jacks 25T (button type)	As required
18	Hydraulic jacks 10T (button type)	As required
19	Hydraulic jacks 5T (button type)	As required
20	Turn buckles 10T	25
21	Screw jack 20 MT	2
22	Eye bolt	As required
23	Manila rope	As required
24	Skid roller (hillmen roller)	24
25	Web sling	As required
26	Taper wedge jack	As required
	<u>WELDING</u>	
27	Welding generator machine /welding rectifier	50
28	High frequency TIG welding machine	25
29	Mother oven	3
30	Portable oven	40
31	Grinding Machine	As required
32	Fume extractors with hose.	15
33	Low clearance split type pipe beveling machine 40" pneumatic with compressor	1
34	Pipe beveling machine upto 12"	1
35	Pipe beveling machine upto 24"	1
36	Pipe bending machine	As required
37	Plasma cutting machine	As required
38	Pug cutting machine	As required
39	Gas cutting set	As required

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40	Fitter tool kit	As required
41	Engraving machine	As required
42	DG sets of required capacity	1
	<u>NDT</u>	
43	RT source with camera, source strength upto 90 curie	1
44	RT source with camera, source strength upto 50 curie	1
45	UT machine (Krautkrammens/panametrics etc,,)	1
46	RT film Digitization equipment	1
47	Vacuum box (of different profiles), vacuum pump along with accessories	As required
48	DPT Sensitivity crack specimens	
	<u>Facilities</u>	
49	Pickling/ passivation facility	As required
50	Painting facilities with suitable machines for grit blasting and painting (Primer, high/medium/low temperature paints)	As required
51	RT source pit, dark room, viewing facility	As required
52	Argon station for purging	As required
53	Electrode storage facility with dehumidifiers	1
	<u>Insulation/HVAC</u>	
54	Weaving machine/Motorized stitching machine	4
55	Shearing machine upto thickness 5mm	1
56	Forming machine for insulation	1
57	Folding machine for insulation	1
58	Plate/sheet rolling machine	1
59	battery operated hand drilling machine	As required
	<u>Machines</u>	

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60	Tool room Lathe	As required
61	Hand Drilling machine	As required
62	Insitu boss (O-let) magnetic base drilling machine	As required
63	Air Compressor 400 cfm	1
64	Bench Grinding machine	As required
65	Flexible grinding machine	2
66	Torque wrench of various capacities	As required
67	Hydraulic torque wrench of various capacities	As required
68	Radial drilling machine	1
69	Power hacksaw	1
	<u>Testing and Measurements</u>	
70	Total station, LC 0.5 sec, 0.1mm	1
71	Theodolite, 1 sec	1
72	AUTO LEVEL INSTRUMENT, 0.2 mm	1
73	Precision AUTO LEVEL INSTRUMENT, LC- 0.02 mm	1
74	JIG TRANSIT,	1
75	VERTICAL OPTICAL INSTRUMENT,	1
76	Master level with LC 0.02mm/mtr	As required
77	Surface plate	1
78	Dial gauges with magnetic base 0.01mm	10
79	Inside micrometer up to 850 mm	As required
80	Straight edge,1 mtr	1
81	Straight edge,0.5mtr	1
82	Telescopic gauge	As required
83	Feeler gauge 300 mm (0.05 to 1 mm)	1
84	Feeler gauge	As required

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85	Pressure gauges (Analogue/ digital)	As required
86	Electric hydro test pump up to 250Kgf/cm ²	1
87	Electric hydro test pump up to 100Kgf/cm ¹	1
88	Electric hydro test pump up to 50Kgf/cm ²	2
89	Manual operated hydro test pump up to 10Kgf/cm ²	4
90	Vernier calipers,1000 mm	1
91	Vernier calipers upto 300mm	2
92	video Boroscope for FME inspection upto 30 mtr length	2
93	Water pot with micrometer	1
94	U- tube manometer	As required
95	Elcometer for Both SS/CS	2
96	WFT gauge	As required
97	Holiday/Adhesion/Hardness tester	1
98	Scrapping tool	As required
99	Welding inspection gauge	As required
100	Inflatable purge dams of various sizes	As required
101	Surface roughness comparator	As required
	<u>Core drilling/cutting</u>	
102	Hilti hammer/core drilling machines	As required
103	Concrete Core cutting machine	As required
	<u>Miscellaneous</u>	
104	Industrial Vacuum cleaner (Both wet and dry)	5
105	Silica gel regeneration oven of 50 Kg	1
106	Pump Required for filling and flushing	1
107	Hot Air blower	1
108	24V transformer	10

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109	Dewatering pumps	5
110	Tap set, Die set and Reamers	As required
111	Scaffolding set	As required
112	Aluminum Scaffolding set	As required
114	Plotter and printers	As required

- 1.4.2 T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity / numbers as mutually agreed at site for major T&Ps, have to be adhered to. Numbers / time of requirement of T&Ps will be reviewed time to time by BHEL site and contractor will provide required T&Ps / equipments to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation and certification regarding capacity etc. prior to dispatch of heavy equipment. Also, on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.
- 1.4.3 Fill pumps shall be arranged by the contractor, wherever required.
- 1.4.4 For testing LP lines necessary Hydraulic Test pumps/ Hand pumps are to be arranged by the contractor.
- 1.4.5 For handling at store and transportation, contractor shall make his own arrangement.
- 1.4.6 For transportation, material handling, loading & unloading of all components / equipments, the contractor has to make his own arrangements at his own cost. BHEL will not provide any crane / T&Ps for unloading the above components. All necessary T&P such as, Trailers, Cranes Winches, welding generators, Slings, Jacks, Sleepers, Rails etc. are to be arranged by the contractor.
- 1.4.7 All the T & P, lifting tackles including wire ropes, slings, shackles and electrically operated equipment shall be got tested by NPCIL approved competent person of statutory authority. Test certificates obtained from the statutory authority shall be submitted to BHEL/NPCIL for their review and approval. NPCIL Safety clearance shall be obtained before they are actually put on use.
- 1.4.8 Required HYDRA/Crane for completion of piping system has to be arranged by contractor. The age of the contractor deployed cranes upto 40 T should be within 10 years as on date of deployment. Contractor has to provide documentary proof for the age of the crane at the time of deployment to the BHEL Engineer.

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- 1.4.9 Any other T& P, measuring instruments, special tools which are required to complete the entire scope of work shall be arranged by contractor with in the quoted rates.

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VOLUME-IA PART-I CHAPTER – V

1.5 ERECTION & TESTING FACILITIES TO BE PROVIDED BY BHEL

- 1.5.1 List of Erection & Testing facilities to be made available by BHEL to contractor on free of cost on sharable basis for execution of works within the scope of this tender for each unit are as below.
- 1.5.1.1 Valve testing Lab will be provided on sharing basis. However, Shifting, handling & testing of valves to be carried out by contractor at his quoted rates. The contractor shall deploy experienced operator for this purpose at his cost.
- 1.5.1.2 Grit blasting & painting shed. Only empty sheds will be provided by BHEL. Grit blasting & painting equipments are in the scope of contractor.
- 1.5.1.3 Closed fabrication shed. Only empty sheds will be provided by BHEL. Equipment for fabrication are in the scope of contractor.
- 1.5.2 All the erection facilities mentioned in clause 1.5.1 above shall be provided to contractor on shareable basis and the allotment is made by BHEL on need basis for erection / pre-commissioning activities only.
- 1.5.3 Any other Tools & Plants and testing facilities are required for satisfactory completion of the work has to be arranged by the contractor.
- 1.5.4 Necessary electrical / water / air connection required for operation of any of the above equipment shall be Contractor's account.
- 1.5.5 The Contractor shall be responsible for the safe and proper use of the above equipments issued to him. Day-to-day maintenance and operation of equipment's shall be the contractor's responsibility and shall be as per instructions / standard practice of BHEL Engineer
- 1.5.6 In case of non-availability of the above, due to any unavoidable reason, like breakdown, overhaul etc., the contractor shall make arrangement at his own cost to meet the erection schedules. No extra claim will be admitted due to the non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.
- 1.5.7 The contractor shall return the erection facilities provided to him by BHEL in good working condition as and when so desired by BHEL. (Completion or reduction in work load) for diversion for other work.
- 1.5.8 Contractor shall have at all times experienced operators and technicians for routine and breakdown maintenance of the equipment. Any delay in rectification of defects will warrant BHEL rectifying the defect and charging the cost to the contractor.
- 1.5.9 If at any time it is noticed that contractor is not using any of the facilities or equipment properly according to the instructions of BHEL, BHEL will have the right to withdraw any and all such equipment and facilities.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.10 Any loss / damage to any or part of the above equipments shall be to contractor's account and the expenditures on these accounts will be recovered from contractor's bills in case contractor fails to make good the loss.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – VI

1.6 TIME SCHEDULE for each package

- 1.6.1 The entire work of Handling, transportation, pre-fabrication, assembly, welding, erection, inspection & testing of piping and erection of associated equipment along with accessories, structures, insulation for nuclear and nuclear auxiliary systems in reactor auxiliary buildings in Kudankulam Unit 3 & 4 shall be completed within **42 months** from the date of commencement of work at site.
- 1.6.2 During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL to achieve the milestone events as programmed.
- 1.6.3 The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when agreed mutually between bidder & BHEL. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
- 1.6.4 The contractor is required to refer Form 15 – Monthly performance evaluation of contractors in Volume-1 book-2 for all the instructions to be taken immediately after receipt of LOI.

1.6.5 COMMENCEMENT OF CONTRACT PERIOD

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer is final.

1.6.6 MOBILISATION FOR ERECTION AND TESTING

The activities for erection, testing etc shall be started as per directions of Construction Manager of BHEL.

The contractor has to augment his resources in such a manner that following major milestones of erection & testing are achieved on specified schedules mentioned below.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.6.7 TENTATIVE MILESTONE SCHEDULE FOR UNIT 3 & 4

Sl. No.	Milestone Description	Milestone Month (Tentative)	
		Unit 3	Unit 4
1.	Start of work	1 st Month	1 st Month
2	Equipment & Piping erection completion in Safety System building – UKA	24 th month	24 th month
3.	Hydro test completion in Safety System building piping system – UKA (Intermediate milestone M1)	26 th Month	26 th Month
4	Equipment & Piping erection completion in Reactor Annex building – UKB	28 th month	28 th month
5.	Hydro test completion in Reactor Annex building piping system – UKB (Intermediate milestone M2)	30 th Month	30 th Month
6	Equipment & Piping erection completion in Reactor Aux building – UKC	36 th month	36 th month
7.	Hydro test completion in Reactor Aux building piping system – UKC	38 th Month	38 th Month

1.6.8 In order to meet the schedule in general, and any other intermediate targets set, to meet customer/ project schedule requirements, Contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer.

1.6.9 In case the project is to be advanced, the erection works in the scope of the contractor is to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.6.10 MAJOR INTERMEDIATE MILESTONES

Sl. No.	Intermediate Milestone Description	Intermediate Milestone Month (Tentative)		Intermediate Milestone
		Unit 3	Unit 4	
1.	Hydro test completion in Safety System building piping system – UKA	26 th Month	26 th Month	M1
2	Hydro test completion in Reactor Annex building piping system – UKB	30 th Month	30 th Month	M2

Note: Please refer relevant point in Volume IA Part II Chapter 1 for Penalty for Intermediate Milestone

1.6.11 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **42 months** from the “COMMENCEMENT OF CONTRACT PERIOD” as specified earlier for completion of the entire work under this package.

1.6.12 GUARANTEE PERIOD

Guarantee period of Twelve (12) months shall commence from the date of completion of the entire work as specified in contract, as certified by BHEL Engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – VII

1.7 TERMS OF PAYMENT for each package

1.7.1 Secured Advance

Not applicable

1.7.2 Advance for Mobilization

Not Applicable

1.7.3 Interim Payment

1.7.3.1 Interim bills in the form of monthly running bills prepared by the contractor in soft as well as Hard copies shall be based on the quantities executed and measured.

1.7.3.2 Progressive payment against monthly running bills will be made up to 95% value of work executed on Pro-rata basis as per terms indicated in table in the next few pages.

1.7.3.3 Balance 5% payment shall be paid along with Final Bill.

1.7.4 For Retention amount –

Please refer SI No.16 of Vol-1A Part II Chapter-1.

NO CLAIM WHAT SO EVER MAY BE, WILL BE ENTERTAINED UNDER THIS CONTRACT, AFTER DULY SIGNING THE FINAL BILL ALONG WITH MEASUREMENT BOOKS AND ACCEPTED BY BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
1.1	Erection of Static equipment inside Reactor building	10%	Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	45%	Handling, assembly, erection, alignment, fit up, inspection, submission of reports and acceptance by Engineer.	35%	Completion of welding, inspection, testing, submission of relevant reports & acceptance of the Engineer.	5%	submission and acceptance of CCC	5%	On final bill
1.2	Dismantling, shifting, re-assembly and erection of plate type heat exchangers:	10%	upon Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	30%	Handling, disassembly, shifting to the location, submission of reports and acceptance by Engineer.	50%	Re-assembly, erection, alignment, Completion of welding and NDEs, submission of relevant reports and acceptance of the Engineer.	5%	submission and acceptance of CCC	5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
1.3	Erection of Static equipment inside Reactor building	10%	Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	45%	Handling, assembly, erection, alignment, fit up, inspection, submission of reports and acceptance by Engineer.	35%	Completion of welding, inspection, testing, submission of relevant reports & acceptance of the Engineer.	5%	submission and acceptance of CCC	5%	On final bill
1.4	Dismantling, shifting, re-assembly and erection of Rotary Equipment (pump & motor)	10%	upon Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	30%	Handling, disassembly, shifting to the location, submission of reports and acceptance by Engineer.	50%	Re-assembly, erection, alignment, Completion of welding, grouting and NDEs, submission of relevant reports and acceptance of the Engineer.	5%	submission and acceptance of CCC	5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
2.1.1 2.1.2	Cutting and Edge preparation	95%	Cutting, edge preparation, inspection, preparation and submission of approved reports							5%	On final bill
2.2.1 2.2.2 2.2.3	Erection of Carbon steel and stainless steel pipe lines	10%	Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	40%	Stage payment will released after erection of pipe, fit up, preparation and submission of approved reports	40%	after preparation of CRR, hydro test, post hydro test cleaning, preparation and submission of reports	5%	submission and acceptance of CCC	5%	On final bill
2.3 2.4.1 2.4.2 2.4.3 2.4.4	Marking, cutting, fit up and welding of	70%	Fitup and welding, NDE preparation and	20%	Stage payment will released after preparation	5%	submission and acceptance of CCC			5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
2.5 2.6.1 2.6.2 2.6.3 2.6.4	SS / CS pipelines		submission of relevant approved reports		of CRR, successful completion of hydro test, post hydro test cleaning, preparation and submission of the reports						
3.1 3.2 3.3.1 3.3.2 3.4	NDE	90%	Completion NDE as per WD, preparation of report and submission of digitized RT film, preparation and submission of report	5%	submission and acceptance of CCC					5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
4.1.1 4.1.2 4.1.3	Handling, shifting and erection of valves	10%	Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	80%	handling, shifting, erection of valve, preparation and submission of approved reports	5%	submission and acceptance of CCC			5%	On final bill
4.2	Erection of Remote drive assemblies	40%	Stage payment will be made after supply of material, making the drawings as per field condition and fabrication, submission of relevant reports.	50%	after shifting, erection, welding and inspection and successful test operation of the remote drive assemblies	5%	submission and acceptance of CCC			5%	On final bill
4.3	Erection and	30%	upon removing the	60%	Stage payment will	5%	submission and			5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
	welding of Stainless steel valves in Embedded floor Trap		temporary cover, cleaning the trap form concrete slurry, preparation of report and submission for acceptance.		be made for shifting and erection of trap valve, preparation of report and submission for acceptance.		acceptance of CCC				
4.4	Handling shifting and erection of Orifices	10%	Handling, transportation, de-preservation, preparation of IMIR and submission of reports	80%	Handling, shifting, erection of valve, preparation and submission of approved reports	5%	submission and acceptance of CCC			5%	On final bill
5.1.1 5.1.2 5.1.3	Handling, fabrication erection of pipe supports :	35%	Handling, transportation, de-preservation, preparation	25%	shifting, erection, fit-up of the pipe supports in	30%	On completion of welding, inspection and	5%	submission and acceptance of CCC	5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
			of IMIR, fabrication, grit blasting, primer application, preparation of report and submission of reports		location , preparation of reports and submission of reports		submission of relevant reports				
5.2.1 5.2.2 5.2.3	Supply, fabrication , welding and erection of pipe supports	40%	On completion of supplying of raw material with TC , preparation of IMIR, preparation of reports and submission	20%	On completion of fabrication, grit blasting, primer application, preparation of report and submission of reports.	30%	On completion of erection , welding and inspection, preparation of reports and submission of relevant reports	5%	submission and acceptance of CCC	5%	On final bill
6.1	Supply and application of	90%	Application of paint as per requirements	5%	submission and acceptance of CCC					5%	On final bill

Tender Specification No.: BHEL: PSSR: SCT: 1927

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
	painting on pipe supports, metal structures		, preparation and submission of approved reports								
7.1.1.1 7.1.1.2 7.1.1.3 7.1.2.1 7.1.2.2 7.1.2.3 7.1.3	Supply and application of thermal Insulation with cladding of equipment and piping	40%	On completion of supply of raw material with test certificates , preparation of IMIR and submission of relevant reports	25%	On completion of application of aluminium foil, thermal insulation mats, lagging, preparation and submission of reports	25%	On completion fabrication, erection of cladding , inspection, preparation and submission of relevant reports	5%	submission and acceptance of CCC	5%	On final bill
7.2	Cladding on pipelines and equipment	95%	Supply & acceptance, fabrication and erection of cladding on pipeline & equipment.							5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
7.3	Handling, erection of Refractory Insulation	10%	upon Handling, transportation, de-preservation, preparation of IMIR and submission of approved reports	80%	after success full completion of the refractory insulation works	5%	submission and acceptance of CCC			5%	On final bill
7.4.1 7.4.2 7.4.3 7.4.4	Cold Insulation of Pipeline and equipment:	40%	upon supply of raw material with all test certificates , preparation of IMIR and submission of relevant reports	25%	upon application of thermal insulation mats of applicable thickness, lagging, preparation and submission of approved reports	25%	after fabrication, erection of wire mesh , inspection, preparation and submission of relevant reports	5%	submission and acceptance of CCC	5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
8	Erection of stainless steel temporary piping for flushing arrangement & dismantling	10%	upon Handling, transportation, De-preservation, preparation of IMIR and submission of approved reports	60%	after completion of the temporary piping as per the requirements including require inspection and submitting the relevant approved documents	25%	dismantling the temporary piping and submitting the removed material to BHEL custody and preparing and submitting relevant approved reports.			5%	On final bill
9	Erection and welding of O-let/ thermo well lug	85%	after mounting the O-let (including pilot and final drilling) as per requirements and preparation	5%	after preparation of CRR and completion of Hydrotest and preparation and submitting	5%	submission and acceptance of CCC			5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
			and submitting the approved reports		the approved reports						
10.1.1 10.1.2	Supply, fabrication and erection of carbon steel Metal structures	35%	upon supply of raw material and submitting IMIR with TC and submitting the relevant approved reports	55%	Stage payment will be released after fabrication and erection of the metal structure , preparation and submission of the relevant approved reports	5%	submission and acceptance of CCC			5%	On final bill
10.2	Stainless steel structural works										

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
10.2.1	Fabrication and erection of stainless steel structural work	10%	upon handling, transportation and shifting of free issue material to contractor store, preparation of IMIR, submission of approved reports	75%	after fabrication and erection of the structure as per the requirements, preparation and submission of approved reports	10%	submission and acceptance of CCC			5%	On final bill
10.2.2	Supply, Fabrication and erection of stainless steel structural work	45%	upon supply of raw material and submitting IMIR with TC and submitting the relevant approved reports	45%	Stage payment will be released after fabrication and erection of the metal structure, preparation and submission	5%	submission and acceptance of CCC			5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
					of the relevant approved reports						
10.3	Dismantling of metal structure and metal platform	90%	after completion of the intended work , preparation of reports and submitting the approved reports	5%	after the final acceptance of the reports					5%	On final bill
11.1.1 11.1.2 11.1.3 11.2.1 11.2.2 11.2.3	Fixing of anchor fasteners	90%	Fixing of hilti anchor fasteners , preparation and submitting the relevant reports	5%	submission and acceptance of CCC					5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
11.3.1 11.3.2	Sealing of anchor fasteners erected on steel lined areas	90%	fixing the cap and seal welding of cap over the anchor bolts as per the requirements .	5%	submission and acceptance of CCC					5%	On final bill
11.4.1 11.4.2	Marking and diamond core cutting	90%	core cutting as per requirement, removal of debris, cleaning the area , preparation of reports and submission for acceptance	5%	submission and acceptance of CCC					5%	On final bill
12	Miscellaneous works										

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
12.2	Handling & transportation of material within plant site (For materials / items other than those specified in other BOQ items)	95%	after shifting of material to the required location , unloading, preparation of reports and submission for acceptance.							5%	On final bill
12.3.1 12.3.2 12.3.2	Passivation of stainless steel pipe & pipe fittings	95%	Stage payment will released after, successfully completing the passivation works in the							5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
			required area , preparation of reports and submission for acceptance								
12.4	Re-orientation of equipment for flushing works	90%	after, re-orientation & normalizing the equipment to the original position successfully, inspection, preparation of reports and submission for acceptance.	5%	submission and acceptance of CCC					5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
12.5	Nickel gasket replacement for filters , torque tightening:	90%	after success full replacement of the nickel gasket , sorbent loading in the required filters , preparation of reports and submission for acceptance.	5%	submission and acceptance of CCC					5%	On final bill
12.6	Charcoal Loading and sealing in Gaseous filters	10%	On completion Handling, transportation, de-preservation, & submission of IMIR	45%	Cleaning, loading of charcoal and welding	35%	Erection , welding and inspection	5%	submission and acceptance of CCC	5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
12.7.1 12.7.2 12.7.3	Protection of stainless steel liner surfaces:	80%	On completion of supply and laying the rubber sheets in the required location as per the requirement, inspection, preparation of report and submission for acceptance.	15%	after removal of the rubber sheet, cleaning the area, inspection, preparation of reports and submission for acceptance.					5%	On final bill
12.9	Machining of various components										

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
12.9.1	Supply of stainless steel SA 276 - SS 321 Round bars/ Flat bars of various sizes and profiles	95%	after supply of material with required TC and reports, inspection , IMIR preparation, and submission for acceptance.							5%	On final bill
12.9.2	Supply of carbon steel SA 105 Round bars/ Flat bars of various sizes and profiles	95%	after supply of material with required TC and reports, inspection , IMIR preparation, and submission for acceptance.							5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
12.9.3 12.9.4 12.9.5 12.9.6 12.9.7	Machining of various components	95%	after successful completion of machining of the component to the required profile, inspection, preparation of report and submission for acceptance.							5%	On final bill
14.1 14.2	Up keeping	95%	after successful completion of the activity and submission of relevant reports							5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ITEM NO	Description	Stage-1		Stage-2		Stage-3		Stage-4		Final Bill	
		%	Description	%	Description	%	Description	%	Description	%	Description
15.1 15.2 15.3	System hand over checks	95%	after successful completion of the activity and submission of relevant reports							5%	On final bill

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - VIII

TAXES AND OTHER DUTIES

1.8.1 Goods and service Tax (GST) & Cess

1.8.1.1 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.

1.8.1.2 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently

1.8.1.3 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will as below:

BHEL GSTN - 33AAACB4146P2ZL
NAME - BHARAT HEAVY ELECTRICALS LIMITED
ADDRESS - KUDANKULAM NUCLEAR POWER PROJECT UNIT 3 & 4, 2X 1000
MWe KUDANKULAM PO, RADHAPURAM TALUK, TIRUNELVELI
DISTRICT, TAMILNADU - 627106

1.8.1.4 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return.

1.8.1.5 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

1.8.1.6 Further, in case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.

1.8.1.7 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

1.8.1.8 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.8.1.9 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Contractor only.

1.8.1.10 BHEL shall not reimburse any amounts towards any interest / penalty etc., incurred by contractor. Any additional claim at a later date due to issues such as wrong rates / wrong classification by contractor shall not be paid by BHEL.

1.8.2 All taxes and duty other than GST & Cess

The contractor shall pay all (except the specific exclusion viz GST & Cess) taxes, fees, license charges, deposits, duties, tools, royalty, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract and the same shall not be reimbursed by BHEL. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

1.8.3 Statutory Variations

Statutory variations are applicable under the GST Acts, against production of proof. The changes implemented by the Central / State Government during the tenure of the contract viz. increase / decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favour of BHEL. No other variations shall be allowed during the tenure of the contract.

1.8.4 New Taxes/Levies

In case Government imposes any new levy / tax after submission of bid during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract.

1.8.5 Direct Tax

BHEL shall not be liable towards Income Tax of whatever nature including variations thereof arising out of this contract as well as tax liability of the bidder and their personnel. Deduction of tax at source at the prevailing rates shall be effected by BHEL before release of payment as a statutory obligation, unless exemption certificate is produced by the bidder. TDS certificate will be issued by BHEL as per the provisions of Income Tax Act.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER -IX

1.9.0 BILL OF QUANTITY

As mentioned in the Volume II, Price Bid, Part-C

NOTE TO BOQ:

- A) The Price bid contains the consolidated list of BOQ with brief description of items. The quantity indicated in the BOQ / Price bid is approximate only and is liable for variation. Payment will be as per actual quantity executed as certified by BHEL Engineer.
- B) BOQ enclosed in this tender is for one package (Package-A), and the quantity of the second package (Package-B) is same as that of Package-A.
- C) Before filling the Rates in the Price bid, the bidder shall go through the detailed specification of all items of BOQ as well as Scope of Work as specified in relevant Clause of this document
- D) Bidders shall refer Volume II, Price Bid, Part –A for Instructions.
- E) Bidders shall quote 'Total Amount' in the format named 'SCT 1927 Format to quote Total Amount' available in e-Procurement portal and uploaded under 'Packet details -> Tender covers -> Finance '(Cover Type Description - Price Bid)'" available in eProcurement portal.
- F) Any other entry elsewhere in the price bid shall be treated as Null and Void. Quoting of rates in any other form/formats will not be entertained.
- G) The above mentioned 'Total amount' is for the entire Bill of Quantity (BOQ) given in Part -C of the Price Bid.
- H) BHEL has pre-fixed the weightages for the amount of individual items of Bill of Quantity with respect to the 'Total Amount' in Part-C.
- I) Based on the pre-fixed weightages, the amount for the individual items of the Bill of Quantity shall be arrived at. This amount shall be rounded off to the nearest rupee.
- J) Based on the quantities of individual item and the amount arrived in Sl.No.: I) above, unit rate of individual items shall be derived. This unit rate shall be rounded off to four decimal places.
- K) Bidders to note that this is an item rate contract. Payment shall be made for the actual quantities of work executed at the unit rate arrived at as per Sl.No. J) above.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER -X GENERAL

1.10.0 In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following:

1.10.1 Payment Bidders are requested to furnish the following at PSSR-HQ, Chennai immediately after release of Letter of Intent (LOI)

- I. Security Deposit and Additional Security Deposit (As applicable).
- II. Unqualified Acceptance for Detailed LOI/ Work Order.
- III. Rs.100/- Stamp Paper for preparation of Contract Agreement.
- IV. Option (whether a or b of said clause) exercised towards Performance Security Deposit for the subject contract as per Sl. No. 16 of Volume IA Part II Chapter 1 of TCC.

1.10.2 Bidders are requested to furnish the proof of documents for the following at PSSR- Site.

- I. PF Regn No.
- II. Labour License No.
- III. Workmen Insurance Policy No.

1.10.3 In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following.

1.10.4 BOCW Act & BOCW Welfare Cess Act

1.10.4.1 The Contractor Should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice of Commencement /Completion of Building Other Construction Work) to the respective Labour Authorities i.e.,

- a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.
- b) Appropriate State authorities in respect of the project premises which is under the purview of State Govt.

1.10.4.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL

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- 1.10.4.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.,
- 1.10.4.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.
- 1.10.4.5 Contractor shall make remittance of the BOCW cess as per Act in consultation with BHEL as per the rates in force (presently 1%). BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fess paid towards registration of beneficiaries and contribution of beneficiaries remitted.
- 1.10.4.6 Non-compliance to provisions of the BOCW act and BOCW welfare Cess act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum it deems fit. Only upon total compliance to the BOCW act and also discharge of total payment of Cess under the BOCW Cess act by the contractor, BHEL shall consider refund of the amounts.

1.10.5 PROVIDENT FUND

- 1.10.5.1 The contractor is required to extend the benefit of Provident Fund to the labour employed by the contractor in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, the contractor is hereby required to get themselves registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to them by the Provident Fund authorities within one month from the date of issue of this letter of intent. In case the contractor is exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of contractor's failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to BHEL by the customer or paid to statutory authorities by BHEL, such amount will be recovered from payments due to the contractor.
- 1.10.5.2 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.10.6 OTHER STATUTORY REQUIREMENTS

- 1.10.6.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules

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and Valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.

- 1.10.6.2 The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r 78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.
- 1.10.6.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
- 1.10.6.4 The Contractor shall submit copies of Final Settlement statement of disbursement of retrenchment benefits on retrenchment of each workman under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (if applicable) to BHEL along with the Final Bill.
- 1.10.6.5 In case of any dispute pending before the appropriate authority under I D Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.
- 1.10.6.6 In case of any dispute prolonged/pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.
- 1.10.7 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

The following clause is applicable in case the contract value / contract price is Rs. Five crores and above.

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified

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tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.8 RECOVERY OF COMPENSATION PAID TO VICTIM(S) BY BHEL IN CASES OF DEATH/ PERMANENT INCAPACITATION OF PERSON DUE TO AN ACCIDENT DURING THE WORKS

BHEL shall recover the amount of compensation paid to victim(s) by BHEL towards loss of life / permanent disability due to an accident which is attributable to the negligence of contractor, agency or firm or any of its employees as detailed below.

1.10.8.1 Victim: Any person who suffers permanent disablement or dies in an accident as defined below.

1.10.8.2 Accident: Any death or permanent disability resulting solely and directly from any unintended and unforeseen injurious occurrence caused during the manufacturing / operation and works incidental thereto at BHEL factories/ offices and precincts thereof, project execution, erection and commissioning, services, repairs and maintenance, trouble shooting, serving, overhaul, renovation and retrofitting, trial operation, performance guarantee testing undertaken by the company or during any works /during working at BHEL Units/ Offices/ townships and premises/ Project Sites.

1.10.8.3 Compensation in respect of each of the victims:

(i) In the event of death or permanent disability resulting from Loss of both limbs: Rs. 10,00,000/- (Rs. Ten Lakh)

(ii) In the event of other permanent disability: Rs. 7,00,000/- (Rs. Seven Lakh)

1.10.8.4 Permanent Disablement: A disablement that is classified as a permanent total disablement under the proviso to Section 2 (I) of the Employee's Compensation Act, 1923.

1.10.9 GENERAL

1.10.9.1 Site Visit by the Bidder

Prior to submitting his tender for the work, the bidder shall visit, examine and acquire full knowledge & information of necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory

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requirements of various authorities about the site of works at his own expense, and obtain and ascertain for himself on his own responsibility that may be for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

1.10.9.2 The bidder shall satisfy themselves about the following factors:

- i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.
- ii) Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.
- iii) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from.
- iv) Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.
- v) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.
- vi) The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.
- vii) The type of equipment and facilities needed, for and in the performance of the work;
- viii) The extent of lead and lift required for the work in complete form over the entire duration of the contract, and
- ix) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

1.10.9.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

1.10.9.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

1.10.9.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof

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a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

- 1.10.9.6 Scope of work covered under this specification requires quality workmanship, engineering and green belt management along with the supply of all consumables, tools and tackles and testing instruments. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments etc. in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.
- 1.10.9.7 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
- 1.10.9.8 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.
- 1.10.9.9 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.
- 1.10.9.10 The contractor shall carryout additional tests, if any, which the Engineer feels necessary because of site conditions and also to meet system specification.
- 1.10.9.11 The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 1.10.9.12 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 1.10.9.13 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence.
- 1.10.9.14 Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for

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any reasons whatsoever.

- 1.10.9.15 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
- 1.10.9.16 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.
- 1.10.9.17 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.
- 1.10.9.18 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
- 1.10.9.19 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However, completion time for construction, agreed will be subject to the condition that contractor's work is not hampered by the agencies.
- 1.10.9.20 Contractor has to work in close co-ordination with other agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and Construction program have to be planned in such a way that the milestones are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
- 1.10.9.21 The contractor must obtain the signature and permission of the security personnel of the customer / BHEL for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 1.10.9.22 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.
- 1.10.9.23 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.

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- 1.10.9.24 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
- 1.10.9.25 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.
- 1.10.9.26 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on latest ISO 9001 Standards.
- 1.10.9.27 Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.
- 1.10.9.28 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
- 1.10.9.29 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.9.30 On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.
- 1.10.9.31 It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.
- 1.10.9.32 If any item not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.
- 1.10.9.33 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.
- 1.10.9.34 SITE INSPECTION

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- 1.10.9.34.1 BHEL or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.
- 1.10.9.34.2 BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.
- 1.10.9.34.3 Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.
- 1.10.9.35 DOCUMENTATION
- 1.10.9.35.1 Record of Quantity of FREE / Chargeable items issued by BHEL must be maintained during contract execution. Also reconciliation statement to be prepared at regular intervals.
- 1.10.9.35.2 The under mentioned Records/ Log-books/ Registers applicable to be maintained.
- a) Hindrance Register.
 - b) Site Order Book.
 - c) Test Check of measurements.
 - d) Steel & Cement Supply and Consumption Daily Register
 - e) Records of Test reports of Field tests.
 - f) Records of manufacture's test certificates.
 - g) Records of disposal of scraps generated during and after the work completion.
 - h) List of T&Ps and MMEs
- 1.10.9.35.3 Other documents / records as specified in chapter -Progress of work in PART- I of Technical conditions of Contract Volume IA (Volume I Book I).
- 1.10.9.35.4 Schedule as specified in chapters of Technical conditions of Contract Volume IA (Volume I Book I).

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VOLUME-IA PART – I CHAPTER - XI **PROGRESS OF WORK**

The scope of the work will comprise of following but not limited to the following:

1.11.0 PROGRESS AND MONITORING OF WORK

- 1.11.1 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
- 1.11.2 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of non- conformities.
- 1.11.3 Tenderers have to furnish a list of Tools and Plants including cranes, Tractor / Trailers etc., which they propose to deploy for this work.
- 1.11.4 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.
- 1.11.5 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.6 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.
- 1.11.7 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.11.8 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details: -
 - a. Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.

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- b. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.
- c. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operators and helpers.
- d. Consumables report giving consumption of all types of gases and electrodes during the previous month.
- e. Availability report of cranes.
- f. Safety implementation report in the format.
- g. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

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VOLUME-IA PART-I CHAPTER-XII

1.12.0 MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

1.12.1 The scope of the work will comprise of but not limited to the following:

(All the works mentioned here shall be carried out within the accepted rate unless otherwise specified.)

1.12.2 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators Fuel lubricants etc., for loading & unloading of materials will be in the scope of contractor.

1.12.3 The storage yard is located in more than one location within the Main Plant Boundary.

1.12.4 Contractor shall plan and transport equipments, components from storage yard to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.

1.12.5 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

1.12.6 Contractor shall take delivery of the components and equipment's from the storage area after getting approval of BHEL Engineer on standard indent forms specified by BHEL. Complete and detailed account of the equipment's erected as well as progress shall be submitted to the engineer as directed.

1.12.7 Sometimes it may become necessary for the contractor to handle certain un required components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

1.12.8 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.

1.12.9 Open ends of piping valves, pipes and tubes shall be covered with plastic caps or will be closed with wooden plugs as the case may be.

1.12.10 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are

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required for temporary supporting of the components at site.

- 1.12.11 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.

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VOLUME-IA PART –I CHAPTER -XIII

1.13SAFETY CLAUSE/CONDITIONS:

In addition to the clauses in Chapter IX of Special Conditions of Contract (Volume-1B of Book-II) the contractor shall comply with the following. (The clause mentioned in this chapter will prevail in case of contradiction between the clauses in this Chapter and that of Chapter IX of Special Conditions of Contract (Volume-1B of Book-II)).

1.13.1 PROJECT SAFETY PLAN

1.13.1.1 A project specific Health and Safety plan shall be developed by the Contractor and submitted for approval from BHEL, prior to commencement of the work.

1.13.1.2 SAFETY ORGANIZATION OF THE CONTRACTOR:

The following minimum requirement shall be fulfilled:

Sr. No.	Manpower per Shift	No. of Safety Officers to be appointed per shift	No. of Safety Supervisors to be appointed per shift
1	Up to 20	01	01
2	21 to 100	01	02
3	101 to 200	01	03
4	201 to 350	02	04
5	351 to 500	02	05
6	Above 500	1 for every addl. 500 workers in addition to number mentioned against Sr. No. 5	1 for every addl. 200 workers in addition to number mentioned against Sr. No. 5

1.13.1.3 QUALIFICATION OF SAFETY PROFESSIONAL SHALL BE AS FOLLOWS:

- **SAFETY OFFICER:**

Degree in Engineering and Diploma in Industrial Safety, recognized by the Central / State Government

- **SAFETY SUPERVISOR:**

Diploma in Engineering and Diploma in Industrial Safety recognized by the Central/ State Government or 6 years supervisory experience.

1.13.1.4 TRAINING REQUIREMENTS

- i. The Contractor shall provide mandatory Industrial Safety Training to all workmen. For the works where deployment of safety supervisor is not applicable, industrial safety training shall be provided by NPCIL.

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- ii. For all works having manpower less than or equal to 100 persons, the safety training shall be carried out at NPCIL's safety training centre.
- iii. For all works having manpower more than 100, the Contractors shall establish their own safety training centre having adequate seating capacity and infrastructure for training.
- iv. Induction safety training shall be provided to all personnel of the Contractors within the first three days of entry into plant site, failing which the workmen shall not get plant entry pass for further extended period.
- v. After the induction safety training, the workmen should undergo refresher training once in every six months. Safety training card in prescribed format shall be issued to all workmen after completion of training.
- vi. The duration of the training shall be minimum four hours. The typical syllabus for the training is as follows:
 - a) Hazards at construction sites. Use of personal protective equipment and their practical demonstration. Mock drill to ensure proper use of PPEs. Need for preventing accidents.
 - b) Aims and Objectives of safety, pep talk, and housekeeping. Safety Work Permit and Authorization to work on system equipment. Height Pass training and briefing about hazard prompt list.
 - c) DOs and DON'Ts on construction activities. Briefing about location of First aid/Fire station/Safety Section and their telephone numbers. Good safety practices of NPCIL projects.
 - d) Films on construction safety and feedback.
- vii. The safety supervisors and the safety engineers will have to undergo refresher safety training in safety supervision and accident prevention techniques conducted by National Safety Council or other recognized institutions once in a year.

1.13.1.5 REQUIREMENTS AND SPECIFICATION OF PPES

- i. Contractor shall submit a list of PPEs that shall be used during the course of the work, to BHEL before the commencement of work.
- ii. Contractors must maintain adequate stock of Personal Protective Equipment (PPE) and safety gears such as safety nets, fall arrestor systems, safety barricades, signage etc. conforming to relevant Indian standards (or relevant international standards), required to be used during execution of the work.
- iii. These PPE's, tools and appliances must be inspected quarterly by Safety officer / Supervisor of Contractor and records of such inspection shall be submitted to BHEL along with monthly safety report.

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1.13.1.6 **PERSONAL PROTECTIVE EQUIPMENT**

1.13.1.6.1 **GENERAL**

- a) Although the primary approach in any safety effort is that the hazard to the workmen should be eliminated or controlled by engineering methods rather than protecting the workman through use of personal protective equipment (PPE). Engineering methods could include design change, substitution, ventilation, mechanical handling, atomisation etc. Under those situations when it is not possible to introduce any effective engineering methods for controlling hazards, it is necessary that workman use appropriate type of PPE. For example, in construction work there is the possibility of a hand tool, a bolt, or some loose material to fall from an elevated level and striking the head of workman working below. It is therefore necessary that construction worker wear a safety helmet. It is for such situations, both the Factories Act 1948 and the Atomic Energy (Factories) Rules, 1996 have provisions for use of appropriate type of PPE.
- b) It is thus recognized that use of PPE is an important and necessary consideration in the development of a safety programme. Once the safety professional decides that PPE is to be used by workmen, it is essential to select right type of PPE and management should ensure that workman uses it and also PPE is correctly maintained.

1.13.1.6.2 **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

- a) All personal protective equipment as considered necessary should be made available for the use of the persons employed on the site and maintained in a condition suitable for immediate use. Also, adequate steps should be taken by engineer-in-charge to ensure proper use of PPE.
- b) All the PPEs in use should be as per relevant IS standards as referred in the AERB safety guidelines on 'PPE'(AERB/SG/IS-3).
- c) All persons employed at the construction site should use safety helmets. Safety helmet should be with BIS mark and should have its headband with back support and chin strap.
- d) Workers employed on mixing asphaltic materials, cement and lime mortars should use protective goggles, protective foot wears, hand gloves and respirators as required.
- e) Persons engaged in welding and gas-cutting works should use suitable welding face shields. The persons who assist the welders should use suitable goggles. Protective goggles should be worn while chipping and grinding.
- f) Stonebreakers should use protective goggles. They should be seated at sufficiently safe distances from one another.
- g) Safety goggles should be of shatterproof type and with zero power.

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- h) Persons engaged in or assisting in shot blasting operations and cleaning the blasting chamber should use suitable gauntlets, overalls, shatterproof and dust-proof goggles and self-contained breathing apparatus set.
- i) All persons working at heights more than 3.5 m above ground or floor and exposed to risk of falling down should use full body harness safety belts, unless otherwise protected by cages, guard railings, etc. In places where the use of safety belts is not feasible, suitable net of adequate strength fastened to substantial supports should be used.
- j) When workers are employed in sewers and inside manholes that are in use, it should be ensured that the manholes are opened and are adequately ventilated at least for an hour. After it has been well ventilated, the atmosphere inside the space should be checked for the presence of any toxic gas or oxygen deficiency by a competent person and recorded in the register before the workers are allowed to get into the manholes. A pilot team should enter the area donning self-contained breathing apparatus (SCBA). The manholes opened should be cordoned off with suitable railing and provided with warning signals or caution boards to prevent accidents. There should be proper illumination in the night. Depending upon the work situation, the facility should provide PPE including the SCBA as recommended by Head, industrial safety.

1.13.1.7 **WORK PRACTICES**

1.13.1.7.1 **GENERAL**

- a) Prior to taking up the day's work, Pre-Job Briefing/Pep talks will be carried out by Contractors' Site Engineer, Safety officer, Safety Supervisor or Site in charge involving all the workers.
- b) The Contractor shall make arrangements for adequate and qualified supervision during the execution of jobs.
- c) The Contractor shall ensure that safety work permits are taken for each high-risk job as per project procedures.
- d) Job Hazard Analysis (JHA) shall be carried out for all high-risk jobs or as advised by BHEL/NPCIL Engineer-in-charge or Safety Officer.

1.13.1.7.2 **WORK AT HEIGHT**

- a) For carrying out work at height of more than 3.5 meters above floor/ground level, height pass should be provided for all the workers involved in the work as per procedure, which includes ascertaining medical fitness by Registered Medical Practitioner and worker's physical test etc. If any worker is found working at height without required height pass, penalty as per Sr. No.5 of Annexure -1 shall be imposed.
- b) Height work permit shall be obtained for all the works carried out on temporary staging, platforms etc. above a height of 3.5 meters from stable floor or ground floor. All implements used for height work such as scaffold, access stairs/ladders, platform,

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railings etc should be certified by concerned Engineer prior to its use and to the effect that they should have a display card as "Safe for use". Wood, bamboo or other combustible materials shall not be used for making staging/scaffolds.

- c) The minimum 1m width of working platforms shall be maintained. All scaffolds or staging shall have guard rails, mid rails and toe boards. Safe means of access by means of portable or fixed ladders, stairways or ramps shall be provided for all workplaces at height. Cross bracings or frames of scaffold shall not be permitted as means of access.
- d) Safety nets, fall arrestor system, lifelines and other such additional safety measures commensurate with the location and nature of work shall also be provided. Full body safety harness with double lanyard shall only be allowed for work at height.

1.13.1.8 **ELECTRICAL SAFETY**

- a) All electric supply lines and electrical apparatus used at site shall be of sufficient ratings for power, insulation and estimated fault current and of sufficient mechanical strength, for the duty which they may be required to perform under the environmental conditions of installation, and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of human beings, animals and property. All such material and apparatus shall conform to requirements under relevant codes of Bureau of Indian Standards.
- b) Earth pits in accordance with Rule 61 of Indian Electricity Rules, 1956 and as specified in IS 3043:1987, shall be provided and maintained at Contractor's work premises. Healthiness of earthing shall be checked physically at least once in a month and earth pit resistance shall be measured at least once in 6 months.
- c) All power distribution boards, electrically operated equipment/tools, cables, power extension boards etc. shall be inspected every month for ensuring their healthiness. Inspection stickers shall be affixed on all such equipment/tools.
- d) Metal clad power sockets and plugs shall be used at worksites for extension of power to equipment. MCBs shall be used as isolation switch as well as overload protection device. Flexible cables used for extension of power shall be double sheathed three core type. Twisted insulated wires shall not be used for this purpose. The cables used shall be free of joints as far as practically possible. Where joints are essential, the same shall be made as per standard industrial practices. Joints made with insulating tapes shall not be allowed at workplaces.
- e) Earth leakage protection shall be provided to all electrical equipment/ tools/ appliances using ELCB (sensitivity 30mA). ELCBs shall be inspected every month for their healthiness. Apart from the power distribution boards, all extension boards shall also be provided with ELCBs. The specifications for power distribution boards and extension boards shall be in accordance with the requirements of NPCIL.

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- f) If use of electrical energy is required for execution of the work, the Contractor shall deploy qualified and licensed electrician(s). Minimum qualification for such electrician shall be ITI in electrical trade. He should also possess electrician/wireman license issued by concerned state government authority.
- g) At least one portable fire extinguisher (DCP or CO2) shall be provided near each power distribution board.
- h) Rubber mats conforming to IS:15652 shall be used in front of all Power distribution boards.
- i) Rubber hand gloves conforming to IS:4770 and Safety shoes shall be used by personnel working on electrical systems

1.13.1.9 **MATERIAL HANDLING**

- a) All machinery, tools and tackles used for material handling such as cranes, chain pulleys, slings, shackles etc. shall be inspected at least once in 12 months by a Competent Person and records of such inspection shall be maintained. All machinery, tools and tackles used for material handling shall be conspicuously marked with safe working load, date of inspection/test and next due date for inspection/test.
- b) All tools and tackles used for material handling shall be inspected once in a month at site prior to use and damaged/faulty/worn out equipment/tackles shall be immediately removed from the worksite.
- c) Operation of cranes, fork lift trucks, winches etc. shall be carried out only by operators authorized for the purpose. Trained, experienced and authorized signalmen shall be deputed to give signals to the operators of material handling equipment. Except the designated signalmen, no one should be allowed to give signals during material handling operations.
- d) All cranes, fork lift trucks, winches etc. shall be thoroughly inspected once in a month at site by the Contractor.

1.13.1.10 **WELDING, GAS CUTTING AND OTHER HOT WORKS**

- a) Welding machines, gas cutting sets, blow torches, gas cylinders and accessories etc. as well as the connections shall be inspected for their healthiness prior to use.
- b) The return cable of arc welding machine shall be connected to the job. Connecting the return cable to nearest earthed structure shall not be permitted for this purpose. Standard connectors shall be used for connecting welding cables to the welding machine. The current regulator shall also be connected using standard connectors. Use of unsafe means to connect welding cables or regulator shall be avoided.
- c) Welding cables shall be free from joints. In unavoidable cases, the joints shall be adequately insulated both thermally and electrically.
- d) Flashback arrestors shall be provided at torch end as well as cylinder end in gas cutting sets.

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- e) Suitable trolleys shall be used to securely keep and shift the oxygen and DA/LPG cylinders.
- f) Industrial LPG cylinders shall only be used for hot work. Domestic or commercial LPG cylinders shall not be used for this purpose.
- g) At least one fire extinguisher shall be provided at each location of hot work.
- h) All the gas cylinders shall be painted as per standard colour coding. Valve caps shall be provided on cylinder, when not in use.
- i) Gas cylinders shall not be dropped or rolled.
- j) During carrying out hot works, suitable fire preventive measures like, removal of combustible material from the work area, use of fire-resistant blankets etc. shall be strictly followed.

1.13.1.11 **SAFE STORAGE OF MATERIAL**

- a) Contractors shall ensure suitable and adequate place for storage of their material as well as material issued by BHEL/NPCIL. The storage shall be done as per the standard storage requirements based on physical and chemical properties of the material.
- b) Steel structural material, reinforcement rods etc. shall be properly stacked with adequate spacers. The height of the stacked material shall be restricted so as to maintain stability of the pile.
- c) Gas cylinders shall not be stored in open places exposed to sunlight & rain. Storage of gas cylinders shall be done in designated sheds/rooms. Empty and filled cylinders shall be stored separately. Flammable gas cylinders shall not be stored along with oxygen cylinders. Valve caps shall be provided on the cylinders and adequate chaining arrangement shall be provided for protecting the cylinders against falling.
- d) Flammable liquids shall be stored in pre-designated areas having adequate ventilation and firefighting arrangements.
- e) Corrosive chemicals shall be stored in accordance with the instructions given in Material Safety Data Sheet (MSDS). First aid measures for neutralizing the effects of the chemical shall be made available near the storage area.
- f) Smoking of beedi/cigarettes shall be strictly prohibited and sources of ignition shall be strictly controlled in storage areas.

1.13.1.12 **FIRE PROTECTION AND FIREFIGHTING ARRANGEMENTS**

- a) In accordance with the nature of material used during the execution of the job, suitable fire protection and firefighting arrangements, shall be ensured by the Contractor.
- b) Based on the fire load, sufficient numbers of portable fire extinguishers shall be made available at worksites.
- c) All unwanted combustibles shall be removed from the worksites on daily basis.

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1.13.1.13 **TRANSPORTATION OF MAN AND MATERIAL**

- a) Contractor shall ensure safe movement of man and material as well as vehicles within site premises as per applicable rules/regulations. Non-roadworthy vehicles shall not be allowed at worksites.
- b) Vehicles used for transportation of material shall not be used to transport workers.
- c) Overloading of vehicles shall be strictly prohibited.
- d) Protective helmets (IS 4151:1993) shall be used by all two-wheeler drivers.
- e) Vehicles shall have a valid registration, fitness and PUC certificates. Drivers shall have valid driving license.
- f) Vehicles shall be inspected for healthiness once in a month.
- g) Material transported on flat bed trailers shall be properly lashed to prevent fall of material.
- h) Transportation of ODC/OWC material shall be done only with prior permission from BHEL & NPCIL. Adequate warning flags/lights and escorts shall be provided during such movements.
- i) Reversing horns shall be provided in all vehicles.

1.13.1.14 **HOUSEKEEPING**

- a) The Contractor shall at all times keep his work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment.
- b) Welding and other electrical cables shall be so routed as to allow safe traffic by all concerned.
- c) No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The Engineer-In-Charge may require the Contractor to remove any materials which are considered to be of danger or cause inconvenience to the public. If necessary, the Engineer-In-Charge may cause them to be removed at the Contractor's cost.
- d) At the completion of the work, the Contractor shall have removed from the work premises all scaffoldings, surplus materials, rubbish and all huts and sanitary arrangements used/installed for his workmen on the site.
- e) The Engineer-In-Charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.
- f) The safety requirements to be followed at worksites are not limited to those mentioned above. All statutory safety requirements mandated under various applicable Acts and Rules enacted by the Government of India shall invariably be followed at KKNPP. Violation of statutory requirements shall attract punitive/penal actions. In addition, the safety violations during the execution of the present contract will be used as one of the factors for the performance evaluation of the Contractor, which in turn will be used for evaluation of future contracts.

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- g) Similarly, the requirements brought out in AERB Safety Guidelines 'Control of Works', which is a part of the contract documents, shall also invariably be followed.
- h) Violation of such statutory and regulatory requirements shall attract a penalty mentioned in Annexure-1 under respective categories.
- i) Detailed procedures, guidelines, manuals etc. on various aspects of industrial safety periodically issued by NPCIL as a part of the continual improvement process, shall also be followed by the Contractors.
- j) All concerned Section Heads/Engineers-in-charge of the works contract shall be responsible for implementation of these instructions during all stages of execution of the work.
- k) The quantum of penalty to be imposed shall be recommended during monthly Sectional Safety Committee meetings, based on the status of compliance of Safety Related Deficiencies (SRD) reports issued to respective Contractors. The committee shall assess the status of compliance of SRD reports by carrying out survey of workplace. Concerned Engineers-in charge shall deduct the recommended amount of penalty from the monthly RA bill.
- l) The cumulative amount of penalty shall not exceed 2% of the total work-order value.

PENALTY STRUCTURE FOR NON-COMPLIANCE OF SAFETY REQUIREMENTS

Sl. No	Safety Parameters	Penalty structure for noncompliance of safety requirement
1.0	<u>Safety Professional</u> Penalty for not deploying minimum nos. of Safety Professional	Safety Officer - Rs 1500 per day per Safety officer Safety Supervisor- Rs 1000 per day per Safety Supervisor <i>Note: The penalty will also be imposed in case of absence of deployed safety personnel without acceptable replacement. However, the work will be stopped if regular safety personnel is not deployed back within 7 days.</i>

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2.0	<u>Safety Training</u> ➤ Worker found without safety induction training or refresher training ➤ Worker found without safety training card	Rs 1000 per violation
3.0	➤ Non-compliance of Pre-job Briefing, non-availability of JHA, Safety Work Permit or Safe Working Procedure for high risk jobs.	Rs 1000 per violation
4.0	➤ Not providing required PPEs to the workmen ➤ Not using PPEs or using PPEs in incorrect manner or using defective PPEs.	Rs 2000 per violation Rs 500 per violation
5.0	<u>Work at Height</u> ➤ Workers working at height without height pass. ➤ Working at height without Height work permit ➤ Working at height without safe means of access ➤ Width of platform less than 1m Not providing adequate handrails, mid rails & toe guards ➤ Not providing adequate anchorage point for safety harness	Rs. 10,000 per violation
	➤ Unsafe working platform ➤ Not providing safety nets, fall arrestors, life line etc. where required ➤ Using uncertified scaffolds/working platforms ➤ Not providing inspection tags on scaffolds/working platforms	Rs. 10,000 per violation
6.0	<u>Electrical Safety</u> ➤ Use of unsafe/damaged /nonstandard electrical equipment/ appliances ➤ Drawing power supply from power socket without plug ➤ Drawing power without or bypassing ELCB ➤ Faulty/inadequate earthing ➤ Unsafe cable joints	Rs 20,000 per violation

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	➤ Use of non-standard power distribution boards, extension boards ➤ Not carrying out periodic inspection of electrical system/equipment (without inspection stickers on PDBs, extension boards, power tools etc.) ➤ Not providing fire extinguisher & rubber mat near PDBs. ➤ Using polycarbonate switches, plugs and sockets instead of metal clad sockets and plugs ➤ Non-deployment of electrician	
7.0	<u>Material Handling</u> ➤ Use of machinery, tools and tackles not having valid inspection certificate ➤ Use of faulty/damaged material handling equipment ➤ Operation of MH machine/equipment by unauthorized personnel ➤ Not deploying trained signalmen ➤ Not displaying safe working load, date of inspection and next due date on material handling equipment	Rs 15,000 per violation
8.0	<u>Welding, Gas cutting and other hot works</u> ➤ Using faulty/unsafe welding, gas cutting, hot work equipment ➤ Using earthed structure as welding return circuit ➤ Un-insulated joints in welding cable Not using flashback arrestor in gas cutting set ➤ Not ensuring colour coding or valve cap on cylinders ➤ Unsafe handling of gas cylinders Not following fire prevention measures	Rs 5000 per violation

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9.0	<u>Safe storage of material</u> ➤ Unsafe stacking of structural steel material, reinforcement rods etc. ➤ Unsafe storage of gas cylinders, non-chaining of cylinders ➤ Unsafe storage of flammable/ corrosive liquids	Rs 1000 per violation
10.0	<u>Fire protection and Fire fighting arrangements</u> ➤ Not providing fire protection and fire fighting arrangements ➤ Not providing adequate numbers of fire extinguishers ➤ Not removing unwanted combustibles from worksites	Rs 5000 per violation
11.0	<u>Transportation of man and material</u> ➤ Using material transport vehicle for transporting people ➤ Overloading of vehicle ➤ Two-wheeler drivers not using protective helmet ➤ Vehicles used without valid certificates ➤ Unsafe transportation of material Vehicles with faulty reversing horns, head lamps, horns, brakes etc.	Rs 1000 per violation
12.0	<u>Housekeeping</u> ➤ Non compliance of Housekeeping requirements. ➤ Urinating/defecating in non designated places ➤ Spitting in workplaces. ➤ Smoking in workplaces ➤ Writing graffiti in workplaces ➤ Temporary sheds in unauthorized places	Rs 1500 per violation

1.13.1.15 WORK SPECIFIC SAFETY MEASURES

1.13.1.15.1 GENERAL

- a) The occupier should ensure that safety precautions are taken during the execution of awarded work and work areas are maintained safe at all times. At the end of each shift and at all times when the work is suspended, it should be ensured that the work area is left safe in such a way that no materials and equipment that can cause damage to

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- existing property, personal injury or interfere with the other works of the project or station are left in an unsafe manner.
- b) The occupier should ensure to provide and maintain all lights, guards, fencing, warning signs, caution boards and other safety measures and provide for vigilance as and when necessary for the protection of workers and for the safety of others. The caution boards should also have appropriate symbols.
 - c) Adequate lighting facilities such as floodlights, hand lights and area lighting should be provided at the site of work, storage area of materials and equipment and temporary access roads within the working area.
 - d) All works should be planned so as to avoid interference with other facilities, works of other contractors or sub-contractors at the site. In case of any interference, necessary coordination should be ensured for safe and smooth working.
 - e) It should be ensured that the instructions given by the safety officer or his designated nominee regarding safety precautions, protective measures, housekeeping requirements, etc. are complied with. The safety officer with due intimation to engineer-in-charge should have the right to stop the work, if in his opinion, proceeding with the work will lead to an unsafe and dangerous condition. Engineer-in charge should arrange to get the unsafe condition rectified and/ or provide appropriate protective equipment.
 - f) Engineer-in-charge should ensure that each job with a hazard whether small or big is intimated to the safety officer of the facility well before it is taken up.
 - g) The facility should be fully responsible for non-compliance of any of the safety measures or requirements, implications, injuries, fatalities, dangerous occurrences and compensation arising out of such situations or incidents.
 - h) Maximum duty hours of an individual should be as per the Factories Act 1948 or its latest amendment.
 - i) Illumination levels should be as per the statutory requirements.

1.13.1.15.2 **ROCK BLASTING**

- a) All blasting operations should be carried out on the basis of procedures approved by Head, industrial safety and engineer-in charge. All works in this connection should be carried out as per BIS specification/code (IS 4081: 1986. Title: - Safety code for blasting and related drilling operations (First Revision)). Barricades, warning signs etc. should be placed on the roads/open area.
- b) Blasting permit should be obtained from Head, industrial safety at least one day before the blasting operation and precautions mentioned there in shall be ensured by the engineer-in-charge before blasting operation.
- c) The blaster should have a licence from competent authority under Explosive Rules, 1983 for blasting work. It should also be ensured that he knows about the risks involved.

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- d) Blasting should be done under the supervision of competent engineer/ supervisor.
- e) Blasting in the open site should only be carried out during fixed hours every day/fixed day in the week between sunrise and sunset. Residents of adjacent area should be informed in advance about the blasting schedule.
- f) No blasting should be undertaken during thunderstorm.
- g) Necessary precaution should be taken to ensure the stability/integrity/ safety of the adjacent structure by limiting the peak particle velocity.
- h) No loose material, such as tools, drilling equipment, etc. should be left on the surface to be blasted. Proper muffling arrangement of the blasting area should be ensured to avoid flying of blasted material.
- i) Authorised blaster should personally ensure that all the personnel/ equipment has been removed from the blasting area before the blasting operations.
- j) Blasting area should be free of detonating gas, inflammable objects, sparking or damaged wiring system, stray currents and static electricity.
- k) All electrical lines in blasting area should be de-energised.
- l) Entry of unauthorized personnel should be prevented by displaying warning signs.
- m) In case of misfire, no person should be allowed to approach the blasting site unless it is inspected and cleared by a competent engineer/supervisor.
- n) Explosives and blasting material should be stored only in clean, dry, well-ventilated, suitably constructed bullet/ magazine which should be fire resistant and securely locked. Stock book should be kept accurate and maintained. License should be obtained for storage of explosive as per the Explosives Act, 1884.
- o) Blasting caps, electric blasting caps or primers and detonators should not be stored in the same box, container or room with other explosives.
- p) Precautions against lightening should be provided in accordance with Indian Electricity Rules, 1956 (amended in 2000).
- q) The explosives should be transported in specially designed vehicles bearing a special sign or inscription entitled 'DANGER EXPLOSIVES'. Also, detonators separated from other explosive should be transported in a separate compartment.

1.13.1.15.3 EXCAVATION, TRENCHING AND EARTH REMOVAL

- a) Before taking up excavation work, necessary permission should be obtained from the engineer-in-charge with reference to existing underground services.
- b) The engineer-in-charge of the works should exercise full care to ensure that no damage is caused by him or his workmen, during the operation/excavation etc., to the existing water supply, sewerages, power or telecommunication lines or any other services or works. He should provide and erect before construction, substantial barricades, guardrails, and warning signs around the work area. He should also furnish, place and maintain adequate warning lights, display board, signals etc., as required.

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- c) All trenches 1.2 m or more in depth should at all times be supplied with at least one ladder for every 30 m along the trench. Ladders shall extend from bottom of the trench to at least 1 m above the surface of the ground.
- d) The sides of the trench/pit in soil, which are 1.2 m or more in depth should be stepped back to give suitable slope (angle of repose) or securely held by timber bracing or appropriate shoring/support, to avoid the danger of soil slides from collapsing. The excavated material should not be placed within 1.5 m or half of the depth of the pit whichever is more from edges of the trench/pit. Cutting should be done from top to bottom. Under no circumstances mining or undercutting should be done.
- e) Workers should not be exposed to the danger of being buried by excavated material or collapse of shoring. Measures to prevent dislodgment of loose or unstable earth, rock or other material from falling into the excavation by proper shoring shall be ensured.
- f) The stability and safety of the excavation, adjacent structures, services and other works should be ensured.
- g) All excavated area should be fenced off by suitable railing and installation of caution board to warn the persons from slipping or/ falling into the excavation pit/ mound.
- h) All excavated areas shall have an illumination level of at least 20 lux for night work and a red danger light shall be displayed at prominent place near the excavation site to warn approaching traffic and men.
- i) For removal of earth from an earth mound/excavated heap a written permission should be obtained from the engineer-in-charge of the work. As far as practical, earth should be removed mechanically. Wherever manual removal of earth is involved, earth should be removed from the top by maintaining a slope equal to the angle of re-pose of the earth. Such work should be constantly supervised to ensure that no under-cutting is done and to ensure that no person is trapped.
- j) Dumping of excavated soil should be done at a specified area under proper supervision with respect to signaling, illumination and safety clearance.
- k) It should be ensured that at a construction site of a building or other construction work, every vehicle or earth moving equipment is equipped with a) silencers, b) tail lights, c) power and hand brakes, d) reversing alarm e) search light for forward and backward movement, which are required for the safe operation of such vehicle or earth moving equipment and f) the cab of the vehicle or earth moving equipment is kept at least one meter from the adjacent face of a ground being excavated. g) indicator etc.
- l) It should be ensured that when a crane or shovel is traveling, the boom of such crane or shovel is in the direction of such travel and the bucket or scoop attached to such crane or shovel is raised and without load, except when it is traveling downhill.
- m) Before loading or unloading power trucks or trailers attached to tractors, the brakes should be applied and if vehicle is on a sloping ground, the wheels should be blocked. Handcart should not be used for the transfer of construction/erection materials in the

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construction area. However, if the exigency demands urgent transfer of light materials a small handcart may be permitted with the prior approval of the engineer-in-charge.

- 1.13.1.15.4 It should be ensured that at a construction site of a building or other construction work:
- (i) All transport or earth moving equipment and vehicles are inspected at least once in a week by responsible persons and in case any defect is noticed in such equipment or vehicle, it is immediately taken out of service.
 - (ii) Safe gangways are provided for to and fro movement of building workers engaged in loading and unloading of lorries, trucks, trailers and wagons.
 - (iii) All earth moving equipment, vehicles or other transport equipment be operated only by such persons who are adequately trained and possess such skills as required for safe operation of vehicles or other transport equipment.
 - (iv) Trucks and other equipment are not loaded beyond their safe carrying capacity, which should be clearly marked on such trucks and other equipment.
 - (v) No unauthorized person rides the transport equipment employed in such work.
- 1.13.1.15.5 It should be ensured at a construction site of a building or other construction work that:
- (i) A shovel or an excavator whether operated by steam or electric or by internal combustion used for such work is constructed, installed, operated, tested and examined as required under any law for the time being in force and the relevant national standards.
 - (ii) Buckets or grabs of power shovels are propped to restrict the movement of such bucket or grabs while being repaired or while the teeth of such bucket or grabs are being changed.
- 1.13.1.15.6 It should be ensured at a construction site of a building or other construction work that:
- (i) An operator of a bulldozer before leaving – applies the brakes, lowers the blade and ripper and puts the shift lever into neutral. (
 - (ii) A bulldozer is parked on level ground at the close of the work.
 - (iii) The blade of a bulldozer is kept low when such bulldozer is moving uphill.
 - (iv) Bulldozer blades are not used as brakes except in an emergency.
- 1.13.1.15.7 It should be ensured at a construction site of a building or other construction work that:
- (i) A tractor and a scraper are joined safely at the time of its operation
 - (ii) The scraper bowls are propped while blades of such scraper are being replaced.
 - (iv) A scraper moving downhill is driven in low gear.

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1.13.1.15.8 It should be ensured at a construction site of a building or other construction work that:

- (i) Before a road roller is used on the ground, such ground is examined for its bearing capacity and general safety, especially at the edges of slopes such as embankments on such grounds.
- (ii) A roller is not moved downhill with the engine out of gear.
- (iii) Vehicle carrying excavated material should have proper cover over the driver's cabin.

1.13.1.16 **SAFE MEANS OF ACCESS/PLATFORMS**

- a) Adequate safe means of access and exit should be provided for all work places, at all elevations.
- b) Suitable scaffolds should be provided for workmen for all works that cannot be done safely from the ground, or from solid platform except such short duration work that can be done safely from ladders. Bamboo/wooden scaffolding should not be permitted.
- c) Where the platform for working is more than 3.5 m above ground, the width of the platform should be minimum 1 m.
- d) Ladder should be of rigid construction having sufficient strength for the intended loads. Wooden/bamboo/rope ladders should not be permitted. All ladders should be maintained in good condition. The ladders should be fixed to the ground or rigid platforms. An additional person should be engaged for holding the ladder, if ladder is not securely fixed. Ladder shall be extended from floor to at least one meter above the platform.
- e) A portable ladder should be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical). Ladders should not be used for climbing while carrying materials in hands. While climbing both the hands should be free.
- f) Any working platform on scaffolding or staging more than 3.5 m above the ground or floor should have a guard rail attached, bolted, braced at least 1 m high above the floor or platform of such scaffolding or staging along with mid-rail.
- g) The planks used for any working platform should not project beyond the end supports to a distance exceeding four times the thickness of the planks used. The planks should be rigidly fixed at both ends to prevent sliding, slipping or tilting. The thickness of the planks should be adequate to take load of men and materials and should not collapse. Plywood or packing wood should not be used as planks.
- h) The guardrail should extend along the entire exposed length of the scaffolding with only such opening as may be necessary for the delivery of materials. Standard railing should have posts not more than 2 m apart and an intermediate rail halfway between the floor or platform of the scaffolding and the top rail. Such scaffolding or staging should be so fastened as to prevent it from swaying from the building or structure. Scaffolding and ladder should conform to IS 3696 (Part 1): 1987 and (Part II): 1996.

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- i) Working platforms of scaffolds should have toe boards at least 15 cm in height to prevent materials from falling down.
- j) A sketch of the scaffolding proposed to be used should be prepared and approval by the engineer-in-charge obtained prior to start of erection of scaffolding. All scaffolds should be examined by engineer in-charge before use.
- k) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform or gangway or stairway is more than 3.5 m above ground level or floor level. They should have adequate width for easy movement of persons and materials and should be suitably guarded.
- l) No single portable ladder should be used for access to a height of more than 4.5 m. For ladders up to 3m in length the width between styles (side bars)/width in the ladder should in no case be less than 300 mm. For longer ladders this width should be increased by at least 20 mm for each additional meter of length. Step/rungs spacing should be uniform and should not exceed 300 mm. Portable ladder should be used only for access to work place. In case work place is higher than 4.5 meters, pre-fabricated steel staircase should be used.

1.13.1.17 **WORK AT HEIGHT**

- a) Person to work at height should be medically fit and should have height pass issued by safety section. (Appendix A Part A, B and C). Safety training should be imparted before working at height.
- b) Safety work-permit system for working at height should be obtained from industrial safety section.
- c) At elevated places, secure access and foothold should be provided. Adequate and safe means of access and exit should be provided at all work places for all elevations. Means of access may be portable or fixed ladder, ramp or a stairway. The use of crosses, braces or framework, as a means of access to the working platform should not be permitted.
- d) Linear movement at height should be reduced to minimum. In case of such movement provision for anchoring the safety belt should be made.
- e) Where barricades cannot be installed, a safety net of adequate strength should be installed close to the level at which there is a danger of fall of personnel/fall of objects.
- f) In case where 'work at height' is on asbestos roof, crawling board, roof ladder should be used to walk across the asbestos roof.

1.13.1.18 **ELECTRICAL SAFETY**

- a) All electrical installations shall comply with the appropriate statutory requirements given below and shall be subject to approval of the electrical engineer and safety officer.
 - i. The Electricity Act, 2003
 - ii. The Indian Electricity Rules 1956 (as amended in 2000)

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- iii. The National Electricity Code 2008
- iv. Atomic Energy (Factories) Rules, 1996
- v. Other relevant rules of statutory bodies and power supply authority
- vi. Relevant standards of BIS

In addition to the above statutory provisions, the clauses indicated in this document shall also be complied.

- b) It shall be the responsibility of the user seeking temporary power supply to indicate in writing, if any of the clauses (requirements noted in above regulations and in this document) are conflicting with each other and for which the user cannot decide the course of action regarding safe installation, commissioning, operation, maintenance and decommissioning of the electrical installations.
- c) The electrical engineer and safety officer of the facility providing temporary power supply shall interpret the concerned conflicting clauses and approve in writing the safe course of action.
- d) The Application Form-1 (Form-1A, 1B and 1C) as mentioned in Appendix-B should be submitted by the user for getting the temporary power supply.
- e) After installation of temporary electrical panels, wiring works by the user, certificates as per Form-1D (Appendix-B) should be submitted to the provider.
- f) Certificate of safety officer and authorisation of electrical engineer for energisation of temporary power supply should be filled as per Form-1E (Appendix-B).

1.13.1.19 **MATERIAL HANDLING AND LIFTING MACHINES AND TACKLES**

- a) It should be made compulsory to supervise jobs like lifting/placing/loading/unloading/carrying/transporting etc. of heavy material by qualified supervisor having knowledge about hazards involved and precautions to be taken for such job.
- b) The line managers should ensure that the material handling equipment used is adequate to handle the load.
- c) Manual pulling of heavy equipment and trolley loaded with heavy material is not to be permitted.
- d) Stacking and handling of heavy materials should be done on a firm ground to prevent settlement.
- e) No lifting machine and no chain, rope or lifting tackle, except a fiber rope or fiber rope sling, shall be taken into use in any factory for the first time in that factory unless it has been tested and all parts have been thoroughly examined by a competent person. A certificate of such a test and examination specifying the safe working load or loads and signed by the person making the test and the examination has been obtained and is kept available for inspection.
- f) Use of lifting machines and tackles should conform to relevant BIS requirements [IS 13367 (Part 1): 1992 Reaffirmed 2003, IS 4573: 1982 (Reaffirmed 2000) and IS 13834 (Part 1): 1994 Reaffirmed 2003 etc. The accessories and the attachments, anchorages

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- and supports etc. should be ensured in healthy conditions by regular inspections at defined frequencies.
- g) Every rope used in hoisting or lowering materials or as a means of suspension should be of good quality and adequate strength and free from any defect. This should be ensured by regular inspection as per IS 2762: 1982- Specification for wire rope slings and sling legs (first revision).
 - h) Every crane operator or lifting appliance operator should be authorised. No person under the age of 18 years should be in charge of any hoisting machine or give signal to an operator of such machine.
 - i) In case of every lifting machine (and of every chain, ring, hook, shackle, swivel and pulley block used in hoisting or as a means of suspension) the safe working load should be ascertained and clearly marked. In case of a lifting machine having a variable safe working load, each safe working load and the conditions under which it is applicable should be clearly indicated. No part of any machine should be loaded beyond the safe working load except for the purpose of testing. This should be approved by the engineer-in-charge and head, industrial safety.
 - j) In case of facilities machines, the safe working load should be notified by the engineer-in-charge. As regards the contractor's machines, the contractor should declare the safe working load of the machine to the engineer-in-charge whenever he brings any machinery to site of work and get it verified by the engineer-in-charge, supported by a valid test certificate by the competent person.
 - k) Thorough inspection and load testing of lifting machines and tackles should be done in the presence of competent person at least once in every 12 months and records of such inspections and testing should be maintained.
 - l) No mobile crane should be allowed to move under live high-tension power transmission line.
 - m) While lifting loads, cranes should be located on level ground.
 - n) A thorough load analysis should be carried out before using cranes in tandem.
 - o) Motors, gear transmission, couplings, belts, chain drives and other moving parts of hoisting appliances should be provided with adequate safeguards. Hoisting appliances should be provided with such means, which will reduce the risk of any part of a suspended load becoming accidentally displaced or lowered.
 - p) It should be ensured that the cabin of the lifting machine in outdoor service:
 - (i) Is made of fire-resistant material,
 - (ii) has a suitable seat, a footrest and protection from vibration,
 - (iii) affords the operator an adequate view of the area of operation,
 - (iv) affords the operator adequate protection against the weather, and
 - (v) Is provided with fire extinguisher.

1.13.1.20 **WELDING AND GAS CUTTING**

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- a) Welding and gas cutting operations should be done by qualified and authorized persons only.
- b) Safety work permit should be obtained (wherever necessary like presence of flammable or combustible material etc.) before flame cutting/welding is taken up.
- c) Welding and gas cutting should not be carried out in places where flammable or combustible materials are kept and where there is danger of explosion due to presence of gaseous mixtures. In case the requirement cannot be avoided, specific approval and procedure should be ensured and adequate precautions should be taken.
- d) Welding and gas cutting equipment including hoses and cables should be maintained in good condition.
- e) Barriers should be erected to protect other persons from harmful rays from the work. When welding or gas cutting is done in elevated positions, precautions should be taken to prevent sparks or hot metal falling below on persons or combustible materials.
- f) Suitable type of protective clothing consisting of fire resistant gauntlet gloves, leggings, boots and aprons should be provided to workers as protection from heat and hot metal splashes. Face shields with filter glasses of appropriate shade should be worn.
- g) Adequate ventilation should be provided while welding, brazing and cutting the metals like zinc, brass, bronze, galvanised or lead coated material.
- h) Welding and gas cutting on drums, barrels, tanks or other containers should be taken up only after ascertaining that they have been emptied, cleaned thoroughly and made free of flammable material.
- i) Fire safety measures should be available as required near the location of welding/cutting operations.
- j) Flash back arrestor should be provided with gas cutting and gas welding sets.
- k) For electric (Arc) welding the following additional safety precautions should be taken:
 - i. When electrical welding is undertaken the return lead of welding machine should be directly connected to the job invariably.
 - ii. Provision must be in place in electric welding machine to prevent physical contact with live parts.
 - iii. The welding cables and power cables should be routed separately to avoid entanglement.
 - iv. The electric welding set should have suitable earth connections. There should be an electrical isolation device in the input power supply side on the welding machine.
 - v. Double gauges should be used for all gas cylinders used for cutting/ welding. Pressure gauges/regulators should be in healthy condition.

1.13.1.21 **ROTARY CUTTERS/GRINDERS**

- a) All portable cutter/grinders should be provided with the wheel guard in position.

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- b) Grinding wheels of specified diameter only should be used on all grinders in order to limit the prescribed peripheral speed.
- c) In pedestal grinder, the gap between tool rest and grinding wheel should be maintained less than 3 mm.
- d) Goggle/face shield should be used during grinding operation.
- e) No grinding wheel should be used after its expiry date.
- f) Ear muff/ear plug should be used during the welding/cutting jobs.
- g) Portable appliances, which are powered by single phase AC supply, shall be provided with three-core cable and three pin plug, otherwise the whole body should be double insulated.
- h) Safety work permit should be obtained (wherever necessary like presence of flammable or combustible material etc.) before grinding is taken up.
- i) Fire safety measures should be available as required near the location of grinding operations.

1.13.1.22 **CONCRETE MIXING EQUIPMENT**

- a) Cement bags should be stacked on wooden planks in dry and leak proof area, 150 mm to 200 mm from the floor and 450 mm away from walls. Height of the stack should not be more than 15 bags or 1.5 meters whichever is lower. Width of the stack should not be more than 4 bags or 3 meters. Lateral loading of the walls of the storage room by stacking should not be permitted. Stacking of the bags should not be used as a working platform.
- b) Shuttering and supporting structures should be of adequate strength and approved by engineer-in-charge. This should be ensured before concrete is poured.
- c) If the mixer has a charging skip the operator should ensure that the workmen are out of danger before the skip is lowered.
- d) Adequate walking platforms (as per the AERB directives) are to be provided in the reinforcement area to ensure safe walking for pouring concrete on the roof.
- e) When workmen are working/cleaning the inside of the drum of mixer, the power of the mixer should be switched off and "Do not operate" tag should be provided. The plant operation and cleaning of mixing pan should be carried out as per equipment supplier's instructions.
- f) Interlocks between the cover and the mixer rotor shall be established to ensure that the agitator does not start when the cover is in open condition.
- g) It should be ensured that moving parts of the elevators, hoists, screens, bunkers, chutes and grouting equipment used for concrete work and of other equipment used for storing and transporting of ingredients of concrete are securely fenced to avoid contact of workers with such moving parts.
- h) It should be ensured that screw conveyors used for cement, lime and other dusty material are completely enclosed.

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- i) Workers engaged for handling bulk cement in a confined place should be provided with tight fitting goggle, approved respirators and protective clothing, which will fit snugly around the neck, wrist and ankles.
- 1.13.1.22.1 The following should be ensured for every pipe carrying pumped concrete:
 - i. The scaffolding carrying a pipe for pumped concrete should be strong enough to support such pipe at a time when such pipe is filled with concrete or water or any other liquid and to bear safely all the building workers who may be on such scaffold at such time.
 - ii. Securely anchored at its end point and each curve on it.
 - iii. Provided with an air release valve near the top of such pipe; and securely attached to a pump nozzle by a bolted collar or other adequate means.
- 1.13.1.22.2 The following should be ensured while using the electric vibrators in concreting work at a construction site of a building or other construction work such that:
 - i. Such vibrators are earthed.
 - ii. The leads of such vibrators are heavily insulated.
 - iii. The current is switched off when such vibrators are not in use.
- 1.13.1.22.3 For obtaining a clearance for first pour of concrete and regular operation of ready-mix concrete (RMC) plant, checklist given in Appendix-C shall be submitted to AERB along with the application for clearance.
- 1.13.1.23 **PAINTING**
 - a) Appropriate breathing air respirators should be provided for use by the workers when paint is applied in the form of spray, or a surface having lead paint is dry rubbed or scraped.
 - b) Only the quantity of paint, thinner and polish required for the day's work should be kept at the work spot. Excess storage should not be permitted at the work spot.
 - c) Smoking, open flames or sources of ignition should not be allowed in places where paints, varnish, thinner and other flammable substances are stored, mixed or used. A caution board, with the instructions written in national language and regional language, 'SMOKING - STRICTLY PROHIBITED' should be displayed in the vicinity where painting is in progress or where paints are stored. Symbols should also be used on caution boards.
 - d) All electrical equipment of paint storage room should be of explosion proof design. Suitable fire extinguishers/sand buckets should be kept available at places where flammable paints are stored, handled or used.
 - e) When painting work/hot resin mix is done in a closed room or in a confined space, adequate ventilation should be provided and ensured. In addition, suitable respirators should be provided. No portable electric light or any other electric appliance of voltage exceeding 24 volts should be permitted for use inside any confined space. Walkie-

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- talkie or other means of communication should be provided. Rescue arrangement like full body harness with lifeline, tripod with pulley and extra BA sets should be available.
- f) The workers should use PVC gloves and/or suitable barrier creams to prevent the skin contact with Epoxy resins and their formulations used for painting.

1.13.1.24 **DEMOLITION**

- a) Before any demolition work is commenced and also during the progress of the work, all roads and open area adjacent to the work site should either be closed or suitably cordoned. Appropriate warning signs should be displayed for cautioning approaching persons/ vehicles.
- b) Before demolition operations begin, it should be ensured that all the service lines are de-energized.
- c) Persons handling demolition operations shall use appropriate PPE.
- d) All demolition operations should be carried out with safe and duly approved procedures which shall include following but not limited to:
- i. No masonry/material should be permitted to fall in such masses or volume or weight so as to endanger the structural stability of any floor or structural support.
 - ii. No wall, chimney or other structure or part of a structure is left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration.
 - iii. No floor, roof or other part of the building should be overloaded with debris or materials as to render it unsafe.
- e) After the demolition, the debris and other materials collected should be disposed safely and not permitted to be dropped freely.
- f) Entries to the demolition area shall be restricted to authorized persons wearing safety helmets and safety shoes.

1.13.1.25 **TRAFFIC**

- a) All the vehicles moving at sites should conform and comply with the requirements of Motor Vehicles Act, 1988 and the Rules made there under. All the drivers/operators of vehicles should possess valid driving license as per Motor Vehicles Act, 1988 or its latest amendment.
- b) The facility should conduct operations so as to interfere as little as possible with the use of existing roads at or near locations where the work is being performed. When interference to traffic is inevitable such as road cutting or transit unloading of heavy equipment etc. notice of such interference should be given to the engineer-in-charge and safety officer well in advance with the details of start of the work and time required.
- c) A cleaner/assistant must be available for all heavy vehicles whenever vehicles move forward as well as in the reverse direction. All vehicles should be fitted with proper reverse horns, back view mirrors and indicator signals.

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- d) Facility should ensure that the assessment of the driver's visual ability is carried out as per Rule 55 of the Atomic Energy (Factories) Rules, 1996/guidelines of advisory committee on occupational health (ACOH), AERB or as per the latest amendments in statutes.
- e) Effective speed breakers with yellow stripes on the roads to regulate the speed at the vulnerable points should be installed. Effective barricading with adequate caution signs should be placed to warn the vehicle drivers whenever the jobs are carried out on the road.
- f) All vehicles moving at the site should have roadworthiness certificate issued by the concerned authority.
- g) Special limit boards and caution boards indicating turns should be installed wherever necessary.
- h) In general, the following maximum speed limits should be specified and implemented. Vehicles speed limits should be as per Motor Vehicle Act or 20 Km/h. Extra precautions and care should be exercised particularly during heavy material/equipment movements.
- i) Safety awareness programmes should be conducted for all the drivers of the light, medium and heavy vehicles.

1.13.1.26 **WORK IN RADIATION AREA**

The facility should follow the stipulated procedure under Atomic Energy Radiation Protection Rules, 2004 and AERB safety manual on 'Radiation Protection for Nuclear Facilities' (AERB/NF/SM/O-2) regarding work in the radiation area and other works related with radiography.

1.13.1.27 **WORK IN AND AROUND WATER BODIES**

- a) When work is done at a place where there is risk of drowning, all necessary rescue equipment such as life buoys and life jackets should be provided and kept ready for use.
- b) All necessary steps shall be taken for prompt rescue of any person in danger and adequate provision should be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work. Proper record of entry/exit to and from water bodies shall be maintained on shift basis and search operation shall be conducted as soon as any person is detected to be missing.
- c) Caisson Work
 - (i) Safe means of access should be provided to the place of work in the caisson and adequate means should be provided to safely reach the top of caisson in the event of inrush of water
 - (ii) The work relating to construction, positioning, modification or dismantling of caisson shall be done under the supervision of a responsible person.

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1.13.1.28 **FIRE SAFETY**

- a) All provisions for fire safety shall be complied as per AERB safety standard on 'Fire Protection Systems for Nuclear Facilities' [AERB/ NF/SS/FPS (Rev. 1)].
- b) All necessary precautions should be taken to prevent outbreak of fires at the construction site. It should be ensured that all hot work is carried out under valid work permit.
- c) Combustible materials such as wood, cotton waste, oil, coal, paints, chemicals etc., should be segregated and kept to the required bare minimum quantity at work place.
- d) Containers of paints, thinners and allied materials should be stored in a separate room which should be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint should be kept covered or properly fitted with lid and should not be kept open except while using.
- e) Adequate number of trained persons from approved fire training centre required to extend fire safety coverage should be ensured.
- f) Fire extinguishers as approved by the engineer-in-charge/in-charge of fire station/safety-in-charge should be located at the construction site at appropriate places.
- g) Adequate number of trained workmen in fire fighting who can operate fire extinguishers should be ensured.
- h) Portable fire extinguishers with periodic inspection, maintenance and re-filling complying with the mandatory requirements should be ensured.
- i) Availability of adequate water for fire fighting should be ensured.
- j) Implementation of the provisions of various statutory licenses for storing gas cylinders, petroleum products, explosives etc. as per the relevant acts and rules should be ensured wherever required.

1.13.1.29 **ENVIRONMENTAL SAFETY**

Relevant provisions of the state/central statutory authority regarding environment protection should be adhered to.

1.13.1.30 **PUBLIC PROTECTION**

The Facility should make necessary provisions to protect the public. He should be bound to bear the expenses in defence of every action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of any precaution required to be taken to protect the public. He should pay for the any such damage and cost which may be awarded in any such suit, action or proceedings to any such person, or the amount, which may be fixed as a compromise by any such person.

1.13.1.31 **SAFETY OF VISITORS**

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- a) Visitors for the project shall be given health and safety induction before they are allowed in to the construction project. It shall include the minimum PPE to be used, hazards and risks at the work area, restricted areas of entry, emergency response arrangements, etc.
- b) Visitors shall always be accompanied by one of the employees of the project site.
- c) Visitors shall not be allowed in the hazardous areas unless they are competent and trained to work in such areas.

1.13.1.32 **HOUSEKEEPING**

- a) It should be recognised that a proper place for everything and everything in its place is maintained for a good housekeeping.
- b) The material required for immediate use only should be brought to the designated workplace and stacked properly and labelled suitably.
- c) All work spots, site office and surroundings should all times be kept clean and free from debris, scrap, concrete muck, surplus materials and unwanted tools and equipment. A day-to-day collection and disposal of scraps/debris should be done safely at designated place.
- d) Electrical cables, leads and hoses should be so routed as to allow safe traffic by all concerned. Cable should be preferably supported on the brackets fixed along the wall to maintain safe access. Wherever routing on the floor cannot be avoided, care should be taken to ensure mechanical protection of these cables and safe access is not disturbed.
- e) No material on any work place should be so stacked or placed or disposed off as to cause danger, inconvenience or damage to any person or environment.
- f) All unused scaffoldings, surplus/scrap materials and equipment/ systems like temporary electrical panels etc. should not be allowed to accumulate and shall be removed from the premises at the earliest.
- g) Accumulation of water/oil spillages on the floor or any other workplace should be avoided.
- h) Proper aisle space marking should be provided in all workplaces.

1.13.1.33 **OTHER STATUTORY PROVISIONS**

Notwithstanding the clauses in the above subsections, there is nothing in these clauses to exempt the Facility from the provisions of any other act or rules in force in the Republic of India. In particular, all operations involving the transport, handling, storage and use of explosives should be as per the standing instructions and conform to the Indian Explosives Act, 1884 and the Explosives Rules, 1983. Handling, transport, storage and use of compressed gas cylinders and pressure vessels should conform to the Gas Cylinder Rules 2004 and Static and Mobile Pressure Vessels (Unfired) Rules 1981. In addition, The Indian Electricity Act 2003 and Indian Electricity Rules 2005, the

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Atomic Energy Act, 1962, the Radiation Protection Rules, 2004, the Atomic Energy (Factories) Rules, 1996 and AERB safety manual on 'Radiation Protection for Nuclear Facilities' (AERB/NF/SM/O-2) should be complied with.

APPENDIX-A

APPLICATION FOR HEIGHT PASS

PART- A

Group/Section: _____

Agency: _____

1. Applicant's Name : _____
2. Facility address : _____
3. Residential address : _____
4. Age : _____
5. Sex : _____
6. Height : _____
7. Gate Pass No. : _____
8. Name of contractor/agency with whom engaged at present : _____
9. Height pass required for work at _____ m. Height
10. Description of present job : _____
11. Previous experience of working at height : _____

S.No.	Name of the Employer	Duration of Employment	Work Experience
1.			
2.			

12. Does the applicant suffer from any of the following ailments? (If yes details to be given):
 - (a) Blood pressure _____ (b) Epilepsy _____
 - (c) Flat foot _____
 - (d) Frequent headache or reeling sensation _____
 - (e) Mental depression _____ (f) Limping gait _____
 - (g) Aerophobia _____

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Declaration:

I hereby declare that the above information furnished by me is true and correct. I shall always wear the safety belt and tie the life-line whenever working at unguarded heights of 3 m and above. I shall not misuse the height pass issued to me or transfer it to any other person. I shall never come to duty or work at height/depth under the influence of alcohol/drugs.

Date:

Name:

Sign:

(Applicants name and signature or loss time injury (L.T.I) incase he cannot sign. In case of LTI an authorised person shall explain each point/item to the individual and certify on that behalf below the LTI)

I certify that I am satisfied with the above certification of the individual for the application of height pass and request for issue of height pass to him.

Name :

Sign :

(Agency Concerned)

Countersigned by:

Section Head (Facility)

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PART- B

MEDICAL FITNESS CERTIFICATE

Certified that I, Dr. _____ have examined Shri _____
_____ aged _____ on (date) _____ who has signed
below in my presence. General & physical examinations of Shri. _____
_____ do not reveal any abnormality. He does not suffer from any acute/
chronic skin disease or any contagious or infectious disease. His eye sight is normal
with/without glasses. In my opinion, Shri _____ is physically
and mentally fit for working at height.

Details of examinations are given below:

Personal attributes:

1. Height: _____
2. Chest: _____
3. Weight: _____
4. Hearing: _____
5. Sight: _____
6. Skin: _____
7. Heart beating: _____

Medical aspects:

1. Urine: _____
2. Blood pressure: _____
3. Epilepsy: _____
4. Flat foot: _____
5. Frequent headache
or reeling sensation: _____
6. Mental depression: _____
7. Limping gait: _____
8. Aerophobia: _____

Name:

Sign :

Rubber Stamp of
Medical Practitioner
with Reg. No.

Signature of workman:

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PART-C

INDUSTRIAL SAFETY SECTION

(Considering the above medical certificate, the applicant has appeared on the following practical tests conducted by industrial safety section and the results are given below (strike off whichever is in-applicable)

- (a) Wearing a safety belt and tying the rope knot : Pass/fail
- (b) Walking over a horizontal structure at 3 m. : Pass/fail
height wearing a safety belt
- (c) General physique (OK/Not OK)

The above applicant's performance in the above tests has been satisfactory/unsatisfactory due to the following.

So I certify and issue this height pass to Shri _____
with Registration No. _____ in the height pass register. This is valid for one year
from the date of issue i.e. up to _____

Date:

Name:

Sign.:

Scientific Assistant (Safety)

Safety Officer

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APPENDIX-B

FORM - 1

APPLICATION FOR TEMPORARY POWER SUPPLY AND USE OF ELECTRICITY AT WORK SITE DURING CONSTRUCTION

[Prescribed under clause 4.6(d)]

1.	Name and address of user.	
2.	Reference of tender or work order (if applicable)	:
3.	Name & designation of tender/work order issuing authority.	:
4.	Power supply application number†	:
5.	Name and designation of tender/work order/work supervising authority (engineer-in-charge).	:
6.	Expected date of commencement of temporary supply	:
7.	Expected date of decommissioning of temporary supply	:
8.	Voltage level (LV/MV/HV)	
9.	Type of connection (1Ph/3Ph)	
10.	Connected load (Kw)	
11.	Maximum demand (KVA)/Power factor	
12.	Single line diagram* of proposed power distribution scheme along with equipment data sheet (downstream installation after point of connection).	Enclosed (Form-1A)/Not enclosed
13.	Name of overall supervisor and available qualified Staff	Enclosed (Form-1B)/Not enclosed
14.	Auxiliary equipment data sheet (meters, fire extinguisher, first aid box etc)	Enclosed (Form-1C)/Not enclosed
15.	Name and designation of provider's representative to whom the application is addressed.	:
16.	Name and designation of authorized signatory of user, who had submitted this application	:

† Power supply application number shall be different for same user with multiple applications for temporary supply

* All the drawings and tables shall be signed by user's representative indicated against 16 above.

Signature of authorised signatory of user

Signed endorsement of work order
supervising authority indicated
against 5 above.

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FORM - 1A

EQUIPMENT DATA SHEET FOR OBTAINING TEMPORARY POWER SUPPLY AND USE OF ELECTRICITY AT WORK SITE DURING CONSTRUCTION

(Prescribed against item-12 of form-1)

Name and address of user:

Power supply application
Number:

Amendment No:-

References:- Single line diagram (SLD) of the power distribution scheme with all equipment details (Attach the SLD)

1. Identity	2. Type	3. Make & model	4. Manufacturer's S.No	5. Fixed/ Portable	6. Size	7. Last used date	8. Last test date	9. Latest test data	10. Rating

Signature of authorised signatory of user

Explanation of column headers:

1. Identity:- Identification mark/number/tag of equipment in single line drawing and layout drawing. Every equipment in single line drawing and layout drawing shall have suitable identification mark/number/tag.
2. Type:- Cable/CB/MCB/MCCB/ELCB/transformer/lightning arrester/earthing station/earthing connection/motor/lighting fixture/switch/fuse/switch, socket box etc.
3. Make and model:- manufacturer's name and corresponding model no.
4. Manufacturer's S. No:- serial number and date in name plate if available. Else NA
5. Fixed/portable:- Equipment is installed/laid/anchored to surface or portable.
6. Size:- depending upon type of equipment and as desired by provider representative e.g. length for cables or all dimensions if heavy equipment like transformer.
7. Last used date. date of last use else NEW
8. Last test date. latest test date by user or by manufacturer if NEW
9. Latest test data:- IR, HV, resistance, functional test data depending upon the type of equipment as desired by provider's representative.
10. Rating:- name plate rating of equipment like voltage, current, power (apparent, active, reactive), IP of enclosure, size(cable cross section) etc. depending upon the type of equipment and as desired by provider's representative.

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FORM - 1C

**AUXILIARY EQUIPMENT DATA SHEET FOR OBTAINING
TEMPORARY POWER SUPPLY AND USE OF ELECTRICITY
AT WORK SITE DURING CONSTRUCTION
(Prescribed against item-14 of form-1)**

Name and address of user:

Power supply application

Number:

Amendment No:-

Reference:- Layout drawing No. / _____

1. Identity	2. Type	3. Make and model	4. Manufacturer's S. No	5. Fixed/ Portable	6. Size	7. Last used date

Signature of user's representative

Explanation of column headers:

1. Identity:- identification mark/number/tag of equipment in layout drawing.
2. Type:- earthing rod/megger/multi meter/earth resistance meter/fire extinguisher/s and bucket/first aid box/resuscitation chart/rubber mat etc.
3. Make and model:- manufacturer's name and corresponding model no.
4. Manufacturer's S. No:- serial number and date in name plate if available. Else NA
5. Fixed/portable:- equipment is installed/laid/anchored to surface or portable.
6. Size:- depending upon type of equipment and as desired by provider representative.
7. Last used date. NEW for new equipment. NA for passive devices like chart/mat etc.

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FORM-1D

[Prescribed under clause 4.6(e)]

Name of user agency

Power supply application number:-

CERTIFICATE BY THE LICENSED ELECTRICAL CONTRACTOR

Certified that subject installations have been carried out by us or checked by us and is in accordance with I.E. Rules. The documents submitted with subject temporary power supply application (Form-1) is verified by us and the complete installation confirms to these documents.

We shall periodically inspect/check the installation so that no unsafe situation arises during use of this temporary power supply system. We understand that for the entire duration of existence of this temporary power supply system we shall be responsible for any unsafe installation, operation, maintenance, testing of the same which results into any loss of life or material. We shall immediately report to the provider's representative and ensure de-energisation of supply if any unsafe situation arises during use of this temporary power supply system.

Signature of the authorised signatory of licensed electrical contractor

Rubber seal of licensed electrical contractor

Date

CERTIFICATE BY THE USER

Certified that my/our installations have been carried out in accordance with the I.E. Rules and that I/We have employed competent agency/staff to handle the installations which is strictly as per the staff data sheet submitted in Form-1B.

We understand that for the entire duration of existence of this temporary power supply system we shall be responsible for any unsafe installation, operation, maintenance, testing of the same which results into any loss of life or material. We shall immediately report to the provider's representative and ensure de-energisation of supply if any unsafe situation arises during use of this temporary power supply system.

Signature of the authorised signatory of user

Name of signatory

Date

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FORM -1E

[Prescribed under clause 4.6(f)]

CERTIFICATE BY THE SAFETY OFFICER

Certified that I have inspected the electrical installation referred here in after satisfying myself about the safe condition of the installation, I hereby recommend that the service connection be given to the contractor.

Signature of the safety officer

Name:

Date:

AUTHORISATION BY THE ELECTRICAL ENGINEER

The subject power supply application along with completed installation, necessary certificates (as per Form-1 of Appendix-B) is scrutinised by us. The proposal found to be in order and the installation can be energised on _____ in presence of your designated overall supervisor as indicated in Form-1B. Enclosed herewith the test report data sheet Form-1F. You are requested to carry out the periodic testing of equipment and submit the test report periodically as per this form.

Signature of the electrical engineer
of provider

Name of signatory

Date

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FORM - 1F

TEST/MAINTENANCE REPORT DATA SHEET OF EQUIPMENTS OF TEMPORARY POWER SUPPLY SYSTEM AT WORK SITE DURING CONSTRUCTION

(Prescribed against form-1E)

Name and address of user:

Power supply application

Number:

Amendment No:-

1. Identity	2. Type	3. Last tested date	4. Next due date of any test	5 Frequency of IR test	6 Frequency of HV test	7. Frequency of earth resistance test	8. Other tests

Signature of electrical engineer of provider

Explanation of column headers:

1. Identity:- identification mark/number/tag of equipment in single line drawing and layout drawing. Every equipment in single line drawing and layout drawing shall have suitable identification mark/number/tag.
2. Type:- Cable/ CB/ MCB/ MCCB/ ELCB/transformer/lightning arrestor/earthing station/ earthing connection/motor/lighting fixture/switch/fuse/switch, socket box etc.
3. Last test date: - latest test date indicated in Form-1A.
4. Next due date of any test:- as worked out by frequency of tests indicated in subsequent columns.
5. Frequency of IR test:- required frequency depending upon type of equipment and location of installation. NA if not required after installation.
6. Frequency of HV test:- required frequency depending upon type of equipment and location of installation. NA if not required after installation.
7. Frequency of earth resistance test:- required frequency depending upon type of equipment and location of installation. NA if not required after installation.
8. Other tests: - name and description of any other essential tests/maintenance activity and required frequency depending upon type of equipment and location of installation. NA if not required after installation.

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1.14 NPCIL SECURITY RULES & MEDICAL MANAGEMENT

1.14.1 SECURITY RULES

It may be noted that the construction site is within the purview of the Central Industrial Security Force / other security agency engaged by NPCIL. The contractor shall follow all security rules as may be framed by Corporation from time to time regarding removal / movement of materials, equipment and personnel to and from site.

1.14.2 ENTRY/ EXIT OF MANPOWER

1.14.2.1 To ensure traceability/identity each and every person engaged by the contractor will be required to furnish bio-data of labourers / staff in standard format which includes individual photograph, name, present and permanent address, identification mark, and any of the following identity proofs for issue of temporary pass for period of maximum 15 days.

- a) Voter ID
- b) Aadhar Card
- c) Ration Card
- d) Passport
- e) Bank Account Passbook of any Nationalized Bank
- f) Any document certified by a Gazetted Officer which provides photo identity and address of the individual
- g) Driving License
- h) Identity certificate from Native Village Administrative Officer or Elected Panchayat President
- i) PAN Card

1.14.2.2 Within 15 days of issue of temporary pass the Contractor shall submit the police verification certificate and Medical fitness certificate along with standard application format for issue of Regular pass (RFID).

1.14.2.3 For regular entry pass, the contractor engineer / supervisor / staff & labors must obtain the Police verification certificate and regular pass cannot be issued without police verification. The police verification must be carried out by the Police under the Police Station area(s) where the contract person was staying for the last two to three years. The police verification shall be valid for only three years.

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- 1.14.2.4 Minors or physically unfit persons shall not be deployed for the work. On completion of work or on leaving of labour, the RFID cards shall be returned back to NPCIL. **Penalty of Rs 3000 per RFID card (or as revised from time to time) will be levied for non-return / loss of RFID cards/ Damage of RFID. The RFID passes not used for a period of 30 days will be disabled in the system preventing entry of said person. This can be re-validated only through separate approval.**
- 1.14.2.5 The contractor and his personnel shall abide by all security measures imposed by the NPCIL from time to time. Contractor shall also follow all rules and regulations applicable to the area being declared / pronounced from time to time by the authorities of existing Nuclear Power Station in the vicinity or any other statutory orders. The contractor, his employees and agents shall not disclose any information or drawings furnished to him by Corporation. Any drawings, reports and other information prepared by the contractor / by Corporation or jointly by both for the execution of the contract shall not be disclosed without prior written approval of the NPCIL. **No mobile phone with camera is allowed inside the plant premises.**
- 1.14.2.6 On completion of the contract, it shall be the responsibility of contractor to collect the regular passes (RFID) from labourer and return to the Security Section. The contractor shall obtain a certificate in this regard from SECURITY and submit it to EIC along with submission of the final bill.
- 1.14.3 **ENTRY/ EXIT OF MATERIALS**
- 1.14.3.1 During the entry and exit of all the materials brought by contractors at KKNPP 3&4 Project site, the details shall be entered in the Material entry/exit register maintained at security gate. One copy of documents pertaining to materials being taken inside shall be kept with security. While taking the material out, this shall be cross-checked with the inward documents and confirmed.
- 1.14.3.2 Contractors will be allowed to take their materials in/ out of the construction areas from/ to their workshops inside plant premises through material movement format approved by the Project Manager/ Site- in-charge of the contract. For taking materials onward/outward of KKNPP-3&4 Project Site areas (in/ out of the main plant boundary), gate pass in standard format shall be approved through NPCIL. The contractor shall print gate pass book in quadruplicate in approved format of NPCIL for the entry/exit of materials to/from project premises.
- 1.14.3.3 Loading of materials belonging to contractors inside plant premises, on to trucks/ tractor-trailers/ any other vehicles for taking out of plant premises shall be carried out in the presence of security personnel. A formal request for deployment of security personnel stating the time of loading of materials should invariably be sent to security through Engineer well in advance. Contractor's Project Manager/ Site in-charge shall issue a certificate certifying that contractor's materials are only being loaded / shifted out of plant premises.
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1.14.4 **Entry/ Exit of Vehicles**

1.14.4.1 Entry and exit of contractor's vehicles at KKNPP-3&4 Project site shall be controlled through vehicle pass and the application shall be submitted in standard format.

1.14.4.2 Free issue materials could be loaded/ unloaded at Central Stores/ Warehouse between 0900 hours and 1700 hours with the approval of Engineer on the request submitted by the Contractor.

1.14.4.3 Entry pass for contractor's vehicles will be issued on submission of valid registration, insurance and driving license of driver.

1.14.5 **Mobile Passes**

1.14.5.1 Contractors' staff / labour shall be allowed to carry basic model mobile without camera/data card /internet facility in to KKNPP-3&4 Project site areas only on approval. However, entry of mobile in main plant area will be limited / not permitted. The mobile pass issued shall be restricted from time to time. They shall submit the application for mobile pass in standard format through Engineer.

1.14.6 **Photography in Project Premises**

1.14.6.1 Photography in Project Premises is strictly Prohibited.

1.14.7 **EMERGENCY PREPAREDNESS DRILL**

1.14.7.1 KKNPP- 3 to 4 is in the vicinity of operating units KKNPP 1&2. KKNPP Unit 1&2 performs annual mock emergency exercises in accordance with the stipulations of Atomic Energy Regulatory Board as a part of emergency preparedness plan.

1.14.7.2 All the contractor's workmen engaged for KKNPP 3 to 4 works may have to undergo awareness program on emergency preparedness which shall be arranged by NPCIL. The contractor's workmen may require assembling in the identified areas and registering their presence for accounting purpose as on when required. The rates quoted by contractor shall include the cost of delay due to such interruptions.

1.14.8 **LABOUR EMPLOYMENT**

1.14.8.1 EMPLOYMENT OF UNSKILLED PERSONS FROM AMONG THE DISPOSSESSED FAMILIES

1.14.8.2 In addition to Contractor's own labour force, he shall also employ unskilled laborers out of suitable persons from the families within Kudankulam Nuclear Power Project areas whose lands have been acquired for setting up the Project. It is also encouraged to employ the local labour /staff from the neighbourhood of the Project to the maximum possible extent.

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1.14.9 **CORPORATE SOCIAL RESPONSIBILITY**

- 1.14.9.1 The contractor shall note the fact that Kudankulam Project is located in an area which is surrounded by many villages. The contractor may have to carry out welfare activities in these villages to generate goodwill among the people. A few projects may be taken up in the villages under Corporate Social Responsibility Scheme of Contractor's organization as per provisions of section 135 of Company's Act 2013.

1.14.10 **MEDICAL MANAGEMENT**

FIRST AID CENTRE & AMBULANCE FACILITY

One First aid center and Ambulance service are equipped by BHEL inside the Plant Premises. Services of the same will be extended to the workers/ staff injured /ill, while working, in side plant area. Running expenditure to be shared among contractors of BHEL on proportionate basis of contract value. BHEL engineer decision is final in this regard.

In addition to above the contractor has to make following own arrangements with in their quoted rates

MEDICAL FACILITIES

- a) Medical facilities conforming to the provisions of the Atomic Energy (Factories) Rules, 1996 should be provided at all work sites.
- b) well-maintained first aid boxes should be kept at each location of the work by the contractor and availability of the personnel trained in first aid should be ensured.
- c) The facility management/contractor shall make arrangements for the first aid and medical services for the injured or ill persons for prompt attention or aid.
- d) The arrangement can be made by the contractor or an agreement can be in vogue with the facility.
- e) Display of emergency contact numbers of important persons and hospitals and route map of site shall be maintained at designated places.
- f) It should be ensured by the occupier that occupational health monitoring of contract workers is carried out as per provisions of the Factories Act 1948 as per the latest amendment and the stipulations/directions given by Atomic Energy Regulatory Board from time to time.

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MEDICAL MANAGEMENT OF SERIOUS INJURIES

- a) In case of serious injuries, the injured should be shifted to the nearest first-aid centre at site immediately. The opinion of medical officer/ certifying surgeon should be sought immediately for medical management.
- b) After providing the first aid treatment the injured should be shifted to designated medical facility of the site/hospital for further medical assistance, in an ambulance along with a nursing attendant.
- c) The doctor at the medical facility of the site/hospital attending the case shall assess the extent of injuries and render immediate medical aid. If the situation warrants trauma/special care the injured shall be shifted to the referral hospital, having all the requisite facilities for specialised treatment in ambulance along with a medical attendant.
- d) A list of such referral hospitals for specialised medical management facilities for the injured persons should be available with the project management/Head, industrial safety and Head, medical services of the site for ready reference.

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1.15 SUPPLY OF MATERIAL BY NPCIL & CONTRACTOR SUPPLY MATERIALS

1.15.1 SUPPLY OF MATERIALS:

Materials required for the work covered under this tender such as equipment, pipelines, tubes, pipe fittings, valves, supports, and other connected components of systems including welding electrode and filler wire (Russian make) will be supplied as free issue as specified in respective items of BOQ. The actual quantities to be issued will be indicated in working documentation or to be worked out from the drawings by the contractor. The materials shall be released in phased manner depending on the planning / availability of areas based on the schedule of project.

1.15.2 GENERAL:

1.15.2.1 The free issue supply materials issued to the contractor for the work shall not be used or diverted for any other work either on temporary basis or in a replacement basis. Contractor shall ensure that clear and distinct markings made on the free issue items are not obliterated. Contractor shall provide separate area in his works for stocking and storing these materials while these are in his custody.

1.15.3 MATERIAL SUPPLIED BY THE ENGINEER FREE OF CHARGE:

1.15.3.1 SYSTEM EQUIPMENT:

1.15.3.1.1 All the equipment to be erected is supplied by the engineer. The equipment to be erected by the contractor in general will be supplied with edge preparation for piping connection work in accordance with specification for respective system. In the event of equipment being supplied by the manufacturer with no/wrong edge preparation for welding, contractor shall prepare/rectify the same.

1.15.3.2 PIPE LINES MATERIALS:

1.15.3.2.1 Pipe line materials such as pipe, pipe fitting, valves, supports, inline instruments such as orifices, strainers etc., for all systems will be supplied by the engineer.

1.15.3.2.2 The pipeline above 80 NB shall be supplied in pre-fabricated condition with weld edge prepared for further welding with pipeline, valve, equipment etc. Prefabricated pipelines will normally be supplied with field cutting allowance. Contractor shall carry out necessary field measurements, marking, and cutting and weld edge preparation.

1.15.3.2.3 The pipeline 80 NB and below shall be supplied in random / standard length. Cutting to required sizes, edge preparation, fit up & welding shall be done by contractor within the quoted rate.

1.15.3.2.4 All pipe fittings and valves are normally supplied with edge preparation for piping work in accordance with specification for respective systems.

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1.15.3.3 HANGERS & SUPPORTS MATERIALS:

- 1.15.3.3.1 Equipments and pipelines support & its components will be supplied by the engineer. These items shall be incorporated by the contractor into support assemblies which are to be fabricated and installed by the contractor.

1.15.3.4 FOUNDATIONS & EMBEDMENTS:

- 1.15.3.4.1 Foundations for equipment will be provided by the engineer. Embedment in concrete (Building) i.e. pipes penetration; plates called for on the drawings are mostly installed by the engineer at the time of concreting.
- 1.15.3.4.2 Wherever embedment is not provided, Hilti make anchor fasteners shall be installed by the contractor. (Hilti anchor fasteners will be supplied by NPCIL on free issue basis). Rectification of foundations bolts embedded in concrete or rectification of the corresponding holes in the equipment as directed by the engineer, wherever found necessary shall be done by the contractor.
- 1.15.3.4.3 Filling of concrete/dry packing for equipment foundation, filling grout in foundation bolt pockets as per specification and drawings are included in the scope of the contract including supply of grouting/dry packing materials.

1.15.4 WASTAGE ALLOWANCE FOR MATERIAL ISSUED TO THE CONTRACTOR

S.No.	Particulars	Unit	Rate at which Material will be issued	Maximum invisible wastage (Non-Returnable) (%)	Maximums permissible wastage (Returnable in case of free issue) (%)	Qty. to be issued (approx.) per unit
1	Equipment					
1.1	Static and rotary equipments	MT	FREE ISSUE	0%	0%	700
2	Pipeline Parts					
2.1	Stainless steel pipe material	MT	FREE ISSUE	2%	3%	650
2.2	Carbon steel pipe material			3%	4%	

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2.3	Carbon Steel and stainless-steel pipe fittings			0%	0%	
3	Valves					
3.1	Carbon steel and stainless steel valves of various types, orifice, traps, remote drives	MT	FREE ISSUE	0%	0%	280
4	Pipe support material	MT	FREE ISSUE	3%	4%	300
5	Stainless steel Liner and other SS structural steel	MT	FREE ISSUE	2% *	3% *	30

* This percentage can vary as per the cutting plan approved by Engineer-in-Charge.

Note: Cost towards materials wasted over and above the wastage allowance as mentioned above shall be recovered from the contractor as per NPCIL rates.

Electrode and filler wire consumption for various diameters and thickness of pipes of different joint configuration shall be established after award of work by carrying out mock-up test jointly by both the sides and accordingly approval will be obtained from competent authority. The wastage shall be approved based on established mock up / trail test.

Note: Cost towards electrode and filler wire wasted/ consumed over and above the approved percentage shall be recovered from the contractor as per NPCIL rates.

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1.15.5 MATERIAL & SERVICES TO BE ARRANGED BY THE CONTRACTOR:

1.15.5.1 SPECIFIC CONSTRUCTION EQUIPMENT:

- 1.15.5.1.1 The list of Plant & Machineries, construction equipments, tools and tackles are indicated in VOLUME - IA PART – I CHAPTER IV of this tender. The list is indicative and it is the responsibility of contractor to assess the work and arrange to deploy adequate equipments and facilities to meet the target scheduled.
- 1.15.5.1.2 Any other equipment, tools, fasteners which are not listed above but required for completion of work should be procured by the contractor.

1.15.5.2 SITE WORKSHOP:

- 1.15.5.2.1 Site workshops shall be set up by contractor which should have sufficient space and capacity for carrying out the required works. The shop should have concreted and painted floors, and provided with adequate weather protection. The workshops shall consist of pickling shop, general fabrication shop & clean shop for S.S and CS fabrication shop. The size, arrangement of the machines, washing plant and detergent washing plant shall be got approved from the engineer.

1.15.5.3 WELDING & CUTTING GAS:

- 1.15.5.3.1 Contractor shall arrange welding & purging argon gas of purity 99.98% as per specification and cutting gases as required for work with the quoted rates of respective items.
- 1.15.5.3.2 The contractor is proposed to establish argon gas station outside of building for welding of piping work in reactor & reactor auxiliary building and avoid movement of cylinders.
- 1.15.5.3.3 Use of domestic LPG for the works at plant site is not permitted.

1.15.5.4 CONSUMABLE FOR WELDING:

- 1.15.5.4.1 For welding of free issue equipment, pipeline, supports as mentioned above, welding consumables manufactured & conforming to Russian standard will be issued as free of cost for welding. Contractor shall be responsible for storage and accounting.
- 1.15.5.4.2 For welding of material supplied by the contractor such as CS / SS structural work, CS/SS ducting work, NPCIL approved brand welding consumables as specified by the engineer shall be used.
- 1.15.5.4.3 Welding consumables such as grinding wheel, cutting wheel, wire brush, Tungsten electrode, NDE consumables for entire work is included in the scope of contractor without extra cost.

1.15.5.5 MATERIAL SUPPLY FOR SUPPORT AND OTHER WORKS:

- 1.15.5.5.1 Generally, the structural steel material indicated in piping & support drawings shall be supplied by the engineer for equipment & piping hangers and supports. Based on the work requirement with the approval of engineer, contractor may supply these materials

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as per equivalent approved for Russian steel. Material Test certificate for the material supplied by contractor are to be produced. Contractor shall arrange for testing without any extra charges for all the materials supplied by him if requested by the engineer.

1.15.5.2 Supply of structural steel material for metal structure is included in the scope of contractor.

1.15.6 MATERIAL ACCOUNTING:

1.15.6.1 RETURN AND ACCOUNTING OF MATERIAL:

1.15.6.1.1 The contractor shall maintain material accounting from the day one of starting of work so that material received from BHEL/NPCIL, issued to erection, consumption is updated on day to day basis.

1.15.6.1.2 The contractor has to return / deposit the empty wooden & metal crate on which equipment, pipeline & other components issued on monthly basis.

1.15.6.1.3 Contractor is responsible for accounting of materials issued to them on monthly basis. The consumption of material on system wise shall be compared with respective items as per CIV.

1.15.6.1.4 Welding consumables such as filler wire & electrodes issued as free of charges shall be used only for the items / systems issued. Use of welding consumables on other work / systems is totally prohibited without engineer approval. The consumption shall be available to the engineer on weekly basis with respective quantum of welding completed.

1.15.6.1.5 The contractor shall submit piping & supports material accounting based on "as built drawings" approved by the engineer. These drawings shall form basis for material consumption during the contract period.

1.15.6.1.6 Quantity of welding consumables shall be established and approved for various joint configuration & size of weld joint for respective thickness from start of work and same shall be used for material consumption & accounting purpose.

1.15.6.1.7 The contractor shall segregate all category of material including scrap rendered surplus in order to enable the engineer to determine whether or not permissible cutting wastages were exceeded.

1.15.6.1.8 No wastage will be allowed on the materials issued other than specified and approved.

1.15.6.1.9 The requirement of materials shall be worked out from based on detailed shop drawings approved by the contractor.

1.15.6.1.10 Weights of materials shall be obtained on the basis of unit weights as per relevant standard (Indian /Russian) / drawing in case of materials issued in measurement other than weight. Whenever the weight could not be ascertained from the available drawings/documents, the same shall be obtained by actual weighment of a number of sections of the item and working out the unit weight.

1.15.6.1.11 Periodical check may be exercised by the Engineer on materials issued to the Contractor for which all assistance shall be given by the Contractor.

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- 1.15.6.1.12 All the materials to be returned to the Corporation by the Contractor shall be returned at his own cost. No payment on account of loading, carting and unloading as directed etc. will be made to the Contractor.
- 1.15.6.1.13 On completion of work, the contractor shall return all surplus material available with him to engineer's stores within a period of one month of completion of the works. The material account shall be furnished progressively during the course of the contract and the complete material account must be submitted, within three months of the contract. The contractor must account for the material issued to him as free issue as per the agreement, failing which he shall be charged for loss, misuse and for exceeding permissible cutting wastage limits. He must also account for the piping material, steel/structural, etc. issued on chargeable basis to establish that no material was utilized for unauthorized purposes.
- 1.15.6.1.14 Permissible wastage should not be exceeded. Waste generated shall be accountable subject to the following:

Permissible wastage (Accountable + Un-accountable) allowed towards cutting and fabrication of pipes/structures are as follows

CS Pipes	7%
SS pipes / SS plate	5%
Structural	7%

- 1.15.6.1.15 Out of the above unaccountable / irretrievable wastage shall be allowed upto a maximum of 3% in case of CS structural and plates & 2% in case of SS structural and plates, 3% in case of CS pipes and 2% in case of SS pipes of installed quantity. These figures shall be treated as limits and not as the guidelines for the material account.
- 1.15.6.1.16 Balance wastage shall be accountable by weight for pipe /structural.
- 1.15.6.2 DEFINITION OF PIPE/STRUCTURAL SCRAP:
- 1.15.6.2.1 CS/SS pipes 80mm dia and below – pipe pieces less than 2 meters shall be treated as scrap.
- 1.15.6.2.2 CS/SS pipes, all sizes above 80mm dia - pipe pieces below 1 meter shall be considered as scrap.
- 1.15.6.2.3 Pipe fittings and valves shall not be accepted as scrap. However, the welded fittings and valves, which are rendered surplus by virtue of change in layout, drawings, errors, etc. shall be deposited to engineer's stores after the edges have been prepared by the contractor without any extra charges.
- 1.15.6.2.4 Structural steel member less than 1 meters shall be treated as scrap.

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1.15.6.2.5 CS / SS plate of less than 0.25 SqM will be treated as scrap.

1.15.6.3 CUTTING SCHEDULE:

1.15.6.3.1 The contractor shall furnish the cutting schedule for the acceptance of the engineer prior to starting fabrication of free issue liner work. This is required to cut down the amount of scrap at the end of the contract. Wastage (scrap and surplus) shall be calculated as per approved cutting schedule.

1.15.7 MATERIAL SUPPLY FROM CONTRACTOR:

The following items are required to be supplied as per specification and drawings.

1.15.7.1 Structural steel (carbon steel & stainless steel) such as plate, angle, channel, beams, structural pipes of various sizes including gratings for metal platform work.

1.15.7.2 Ceramic blankets, glass cloth, Aluminum foil, aluminum & stainless-steel cladding for thermal insulation including connected ancillaries.

1.15.7.3 Elastomeric rubber for cold insulation including connected ancillaries.

1.15.7.4 Supply of natural/SBR rubber sheet of required thickness as specified in the drawing with minimum width of 1000mm, with shore hardness of 65 +/-5 shore A. Density 1.5 to 2 g/cc.

1.15.7.5 Epoxy paints of Russian and Indian make.

1.15.7.6 NDE consumables, welding consumables and other erection related consumables.

1.15.8 MATERIALS SUPPLIED BY THE CONTRACTOR

1.15.8.1 The Contractor shall supply all materials required for the work as specified in the drawings from reputed manufacturers as given below in table.

1.15.8.2 The Engineer shall have the right to test random samples to prove authenticity of the test certificates produced by the Contractor at no extra cost to BHEL. Any material not found meeting the requirements shall be rejected and such rejected materials shall be removed from the site.

1.15.8.3 LIST OF REPUTED MANUFACTURES OF VARIOUS MATERIALS

Sl.No	Name of Suppliers / Manufacturer	Confirming to Standards
I	STRUCTURAL STEEL	
1	M/s. TATA Iron & Steel Co. Ltd.	Rolled Sections confirming to IS:2062 Gr.B0 & BR Pipe upto 150 mm IS:1239. Pipes above 150mm IS:3589.
2	M/s. Steel Authority of India Ltd.	
3	M/s. Indian Iron & Steel Co. Ltd.	
4	M/s. Rashtriya Ispat Nigam Ltd.	
II	STAINLESS STEEL	
1	M/s Steel Authority of India Ltd	

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2	M/s TATA Iron & Steel Co	Plates A-240 type 304/ 304L/321
3	M/s India Iron & Steel Co, Ltd	
4	M/s Rashtriya Ispat Nigam Ltd	
5	M/s. MIDHANI	Pipes A-312 type 304/304L/321
III	EPOXY PAINT	
1	M/s. Asian paints	For specifications refer Technical specifications in Vol 1 A Part 2.
2	M/s. Berger paints	
3	M/S Akzo Nobel India Limited	
4	OC-51-03 high temp. radiation resistant paint	Russian Make
IV	INSULATION	
1	M/s Lloyd Insulation M/s Simonds Ceramics M/s Aarvi Industrial Materials M/s FURNACE INDIA	HOT INSULATION-Ceramic Wool
2	M/s- ARMACELL M/s K Flex M/s Aero flex	Cold Insulation-Nitrile rubber
3	M/s Urja Fabrics	Glass Fabric

1.15.8.3.1 Note:

Pre-qualification of materials is not required for the materials, where indicated above. However, material test certificates shall be submitted during supply. For any other materials as well as for the listed materials where new vendor is proposed, the contractor has to make arrangement to pre-qualify the vendor well in advance. The materials are to be procured from the vendors approved by NPCIL. Contractor shall strictly follow this condition, if any materials are found procured from UN -approved vendors of NPCIL are straight away rejected.

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1.16 FOUNDATIONS, GROUTING AND CIVIL WORKS

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.16.1 Foundation for the equipments to be erected shall be provided by BHEL/ clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. Contractor should log before taking over the foundations for erection. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments, plants shall be carried out by the contractor within the quoted rate.
- 1.16.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., de-watering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form / shuttering work are within the scope this work.
- 1.16.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 25 mm for obtaining proper face / elevation for packer plates/shims, and may be required for the erection of the equipment/plants shall have to be carried out as per BHEL Engineers instructions by the contractor within the quoted rate.
- 1.16.4 Preparation of foundation: Providing necessary skilled and other labour to BHEL / Customer for checking of dimensional accuracy, axis, elevation, levels etc., with reference to bench marks of foundations and anchor bolts pits shall be in the scope of the work. Contractor should log before taking over the foundations for erection.
- 1.16.5 The concrete foundation, surfaces shall be properly prepared by chipping, dressing of foundations up to 25 mm as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.
- 1.16.6 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments. All minor adjustments up to 25 mm of foundation level, dressing, chipping of foundation surface

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- enlarging the pockets in foundations and grouting of equipments etc. as may be required for the erection of equipments / plants shall be carried out by the Contractor.
- 1.16.7 Foundation pockets are to be cleaned thoroughly before placing the columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 1.16.8 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.
- 1.16.9 Packer plates should not only be blue matched with foundation but also with foundation frame, inter-packer contact surfaces between the packers and foundation frame etc. Blue matching shall be by Prussian blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.
- 1.16.10 The contractor shall ensure perfect matching of packer plates with foundation by dressing the foundation and between the packer plates and the base plate of structural column / equipment to the satisfaction of BHEL Engineer. Matching of packer shall be carried out by the Contractor at his cost.
- 1.16.11 Contractor shall carry out scrapping and blue matching of embedment plates / packers of rotating equipments so as to achieve prescribed percentage of contact. Chipping and bedding of concrete surfaces, finely dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of the work. The fine dressing of concrete shall be with blue matching checks.
- 1.16.12 Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.
- 1.16.13 BHEL will provide only shims and packer plates (either machined or plain), which will go as permanent parts of the equipment at free of cost.
- 1.16.14 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / sheets at site by the contractor to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting or chiseling, grinding and filing for de-burring the packers at his own cost. Raw materials required for the above will be arranged by BHEL free of cost.
- 1.16.15 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
- 1.16.16 The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification as advised by the Engineer

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or BHEL after preparing the foundation surface for grouting. The contractor has to arrange, a representative from the supplier of special cement for witnessing the grouting and other works at their cost including any miscellaneous expenditure for this activity. BHEL will not pay any service and incidental charges for arranging the supplier representative. The contractor to take note of this aspect and quote accordingly.

- 1.16.17 Grouting of equipments is included in the scope of contractor. All the materials required for grouting including special cements like CONBEXTRA- GP2 or its equivalent grade free flow cement as approved by BHEL/Customer and other materials like Portland cement, sand, gravel etc., are to be arranged by the contractor within the quoted rate. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
- 1.16.18 Contractor shall arrange the required nos. of mixing machines and vibrators at their cost for carrying out the grouting operation. All the materials like cement and cleaning consumables shall also be arranged by the contractor at his cost.
- 1.16.19 The certificates of the grout are to be submitted BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc. to be arranged by the contractor including the fine aggregates.
- 1.16.20 Any additional quantity of grouting materials required for above and also for all other equipments to be arranged by the bidder within the quoted cost.
- 1.16.21 **PROCEDURE FOR GROUTING:**
Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per supplier's recommendation / IS standard. Copy of these recommendations to be submitted to BHEL for records.

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1.17HOUSE KEEPING

1.17.1 MAINTENANCE OF CLEAN SITE CONDITIONS AND HOUSEKEEPING

1.17.1.1 CONSTRUCTION MATERIALS AND DEBRIS

1.17.1.1.1 During the execution of work, the Contractor shall keep the entire site in neat and tidy conditions always by proper housekeeping and stacking of construction materials at site and by removing all debris and waste material regularly, on day to day basis if necessary.

1.17.1.1.2 Contractor shall arrange suitable portable metallic storage bins to store construction materials at site. No material shall be allowed to be spread at site directly on roads / floors. All the garbage and waste material shall be disposed off regularly at the designated area as specified by the Engineer.

1.17.1.1.3 Accumulation and piling up of construction materials /debris/ tool boxes will not be permitted except only at the locations approved for this purpose. Material required for use for next 3 days only shall be stacked in the building keeping a clear passage for movement of personnel.

1.17.1.2 CONTRACTOR'S CONSTRUCTION SITE OFFICE

Contractor's site office within the construction area for his engineers and labour shall be established using the standard Porta Cabins or containers and no site office shall be allowed inside the building. No make shift structures are permitted. The facilities to be built by the contractor shall be aesthetically pleasing and shall match with the general surrounding of KKNPP site.

1.17.1.3 OTHER REQUIREMENTS

1.17.1.3.1 It is also essential that contractor keeps all his moving machinery viz. vehicles etc. in neat and clean condition during entry & exit to/ from plant site and to achieve this contractor shall keep suitable arrangement for washing at his own cost.

1.17.1.3.2 The service lines viz. water, air, power cable, welding lead etc. shall not run on the floor but shall be routed by providing hangers on the walls and ceiling.

1.17.1.3.3 Smoking, chewing of tobacco/Pan etc is not permitted in the Project premises; hence these shall not be brought into the project site. Identity card/Entry pass of any person found indulging in any such activities will be confiscated and will be removed from site without any explanations.

1.17.1.4 TOILET FACILITY AT WORK SITE

1.17.1.4.1 Contractor shall establish toilet facility comprising of urinals and IWCs outside the construction site near rest room at site and labour camp along with water supply arrangements, disposal of waste, lighting, ventilation, washing facility, drainage

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arrangement, cleaning facility, etc., and shall maintain them in clean condition at all times by deploying suitable persons.

1.17.1.4.2 In addition, Contractor shall establish mobile toilet facility comprising of urinals and IWCs within the nuclear island along with provisions for water supply, lighting, ventilation, washing facility, cleaning facility, etc., and shall maintain them in clean condition at all times by deploying suitable persons. The numbers and the location of these toilet blocks shall be decided with the consent of Engineer. These mobile toilet blocks shall be shifted as and when required as the work progresses. As guidance contractor may adopt the design of public toilet facilities provided by M/s.Sulabh International.

1.17.1.4.3 For disposal of the sewage, contractor shall make his own arrangement to connect / dispose the sewage to the STP established by NPCIL at plant site/ labour camp.

1.17.1.4.4 Workers are not permitted to take their lunch in work spot and other erection area of plant. They shall use the covered lunch shed provided by BHEL

1.17.1.4.5 **Note:** BHEL Provide Lunch shed for workers for taking lunch inside the plant area at free of cost. However, agency, workers and all concerned are to co- operate with BHEL for Maintaining the shed in clean condition.

1.17.1.5 **USE OF STORAGE AREAS AND LAND**

Warehouse, shed, workshop and office facilities as required by the Contractor shall be provided by him at his own expenses. Prior approval of the Engineer shall be obtained in respect of location layout and details of these buildings. After the work is completed, these temporary facilities shall be removed by the Contractor at his own expense to the satisfaction of the Engineer.

1.17.2 **HOUSEKEEPING ORGANIZATION OF THE CONTRACTOR**

1.17.2.1 With reference to deployment of housekeeping supervisor, the following minimum requirement shall be fulfilled:

Sr. No.	Manpower per Shift	Housekeeping In charge	No. of Supervisors to be appointed	No. of workmen to be appointed
1	Up to 100	0	01	one sweeper per 200 Sq Mtrs of allotted area
2	100 to 500	01	02	
3	Above 500		1 for every addl. 500 workers in addition to number mentioned against Sr. No. 2	

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1.17.3 **QUALIFICATION OF HOUSEKEEPING SUPERVISOR SHALL BE AS FOLLOWS:**

1.17.3.1 Housekeeping In charge:
Any Degree / Diploma in engineering with two years project/ Industrial experience

1.17.3.2 Housekeeping Supervisor:
+2 with one-year Project/ Industrial experience or Any diploma

1.17.4 **TRAINING REQUIREMENTS**

1.17.4.1 Along with the induction safety training, the workmen should undergo housekeeping training along with safety training.

1.17.4.2 Housekeeping workers shall undergo training in usage of housekeeping equipments and tools such as vacuum cleaners.

1.17.4.3 The typical syllabus for the training is as follows

- Aims and Objectives of housekeeping.
- DOs and DON'Ts on construction housekeeping activities.
- Films on construction housekeeping and feedback.

1.17.5 **REQUIREMENTS AND SPECIFICATION OF TOOLS**

1.17.5.1 Contractor shall submit a list of housekeeping tools that shall be used during the course of the work, to BHEL before the commencement of work.

1.17.5.2 Contractors must maintain adequate stock of housekeeping tools (HKT) and as given below conforming to relevant Indian standards (or relevant international standards), required to be used during execution of the work.

1.17.5.3 These tools and appliances must be inspected quarterly by housekeeping supervisor of Contractor and records of such inspection shall be maintained.

Sl. No.	Description	Minimum Qty. required/available at any given time (in nos) for one major building.
1	Industrial vacuum cleaner (with wet mopping facility)	1
2	Cob webs remover	2
3	Brooms	8
4	CS / Plastic Dustbin	8

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5	Trolley	2
6	Ladders (3mtrs)	2
7	Waste carrying baskets	4
8	Ladders (6mtrs)	1
9	V type ladders	1
10	Cleaning brushes	10
11	Caution board (wet cleaning and cleaning in progress)	16
12	Wet and dry-cleaning duster/cloths	4

- 1.17.5.4 Additional quantity of above equipment and any other item required for works shall be arranged by Contractor without any extra cost. Different major buildings shall be equipped with above tools and for smaller building and structures tools form a pool shall be used.

1.17.6 **HOUSE KEEPING WORK PRACTICES:**

- 1.17.6.1 Housekeeping is very essential to provide safe working area for construction personnel and for movement of the machineries. In order to achieve this objective; a two-part housekeeping policy is adopted. As first part Contractor has to maintain certain housekeeping practices for his own works. In addition to this, for up keeping of overall plant area and areas where multiple agencies work simultaneously, different package Contractors shall be responsible for maintaining general housekeeping in the allocated specific area to them.

1.17.7 **HOUSEKEEPING OF OWN WORKS:**

- 1.17.7.1 The Contractor shall at all time keep his work spot, site office, workshops and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment.
- 1.17.7.2 Welding and other electrical cables shall be so routed to allow safe traffic by all concerned. Cables shall not be spread on floor; it shall be properly supported / clamped along the wall.
- 1.17.7.3 No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The Engineer-In-Charge may require the Contractor to remove any materials which are considered to be of danger or cause inconvenience to the public. In case Contractor fails to comply with the

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instruction of Engineer-In-Charge, he may get the work done at the risk and cost of the Contractor.

1.17.7.4 The Contractor shall on day to day basis remove from the work place all unwanted scaffoldings, surplus materials, rubbish, etc.

1.17.7.5 The Engineer-In-Charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.

1.17.7.6 Contractor shall keep supervisor and supporting staff exclusively for housekeeping of own works.

1.17.7.7 Contractor shall submit the minimum manpower deployment schedule on monthly basis based on the approved housekeeping plan/ schedule for the approval of the ENC.

1.17.8 **HOUSEKEEPING OF THE ASSIGNED AREA / BUILDING:**

1.17.8.1 From the time of release of area/fronts Contractor is responsible for maintaining and up keeping of the all the areas/ SSC under this contract. He shall ensure his sub-contractors maintain proper housekeeping. While handing over the area from the civil Contractor, it shall be ensured that civil works have been substantially completed. This point of time onwards till all works of the Contractor in the building is completed, notwithstanding the fact that other Contractors are also working in the same area; it shall be the responsibility of the Contractor to maintain general cleanliness in the area assigned to him. In order to maintain general cleanliness in the area, the Contractor may take the help / assistance from the agencies working in the same area and he shall also extend all cooperation to other Contractors for such works. However, overall responsibility of housekeeping of the assigned area shall lie with the Contractor.

1.17.9 **GENERAL DESCRIPTION OF WORK**

SL NO	OPERATION	MINIMUM FREQUENCY OF OPERATION
1	Cleaning and Sweeping of construction area, all floors, staircase, platform, and wiping of handrails, equipment, JBs, pipes and etc	Daily
2	Wet mopping of floors	Weekly
3	Vacuum cleaning of floors	Monthly or as and when required
4	Debris removal from dust bin, baskets placed in the respective building.	weekly or as and when required

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1.17.10 **SCOPE FOR EXECUTION OF HOUSEKEEPING WORK:**

- 1.17.10.1 Cleaning and sweeping of construction area, storage area, floors, staircase, platform, anything and everything up to ceiling height and ceiling, as per the frequency indicated in the table.
- 1.17.10.2 Removal of cobwebs, putting the collected debris other than structural materials in the dustbin kept at the specified location on every day basis for the different areas as per agreed schedule. Disposal of collected structural materials within a distance of 2Km on regular intervals.
- 1.17.10.3 Cutting of bushes and up keeping of open storage areas
- 1.17.10.4 Lifting, carrying and disposal of all generated debris such as structural pieces, cable pieces, cable trays, ducts, wooden pieces, packing materials, piping material etc. and all other generated scrap from allotted building within a distance of 2 Km on regular intervals.
- 1.17.10.5 Disposal of debris from dust bins/baskets placed in the respective building within a distance of 2 Km on once in a week basis or as and when required.
- 1.17.10.6 The Contractor shall arrange his own equipment's and tools required for this work like trolleys, ladders, buckets, dust bins, brooms, industrial vacuum cleaner, brushes, wiping cloths or any other material required for the cleaning.
- 1.17.10.7 The storage and security of his materials and equipment shall be the sole responsibility of the Contractor and shall have no right to claim for any loss/theft or damage of the same.
- 1.17.10.8 The exclusive work force shall be deputed for this work and work force deployed for this general housekeeping shall not be diverted for any other job or for his own house keeping jobs.
- 1.17.10.9 All deployed work force shall be provided with dress (with proper code), safety and cleaning gears and in no case work should stop for want of gears.

1.17.11 **PROVIDING WORK FORCE / STAFF:**

- 1.17.11.1 The Contractor shall deploy adequate manpower as per clause 1.17.2 at his own account & responsibility. At the time of allotment of the area for up keeping, the name of contractor's officials in charge for housekeeping, herein after referred as "Housekeeping in charge" (HIC) of the area shall be conveyed by the Contractor to the ENC. These HIC shall report the daily performance to the ENC or his authorized representative.

1.17.12 **REPORTING:**

- 1.17.12.1 The Housekeeping Supervisor(s) should report daily to the AIC (Area in charge) & take day-to-day instructions.

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- 1.17.12.2 The Contractor shall make sure that Housekeeping Supervisor(s) is necessarily available during working hours for receiving & implementing the Instructions of the AIC.
- 1.17.12.3 It shall be the responsibility of the Contractor to get the attendance of the housekeeping staff verified by AIC.
- 1.17.12.4 The weekly / fortnightly / monthly jobs should be planned by Housekeeping Supervisor(s) in consultation with AIC in such a manner that these are spread over the entire week and done during office hours.
- 1.17.12.5 However, certain jobs will necessarily be carried out during Sundays, for which instructions should be taken by the Housekeeping Supervisor(s) from AIC.
- 1.17.12.6 Proper registers/records of the jobs carried out on daily, weekly, fortnightly and monthly basis will be maintained by the Housekeeping Supervisor(s) and
- 1.17.12.7 will be countersigned by the AIC on daily basis and finally at the end of each month by ENC. Approval of ENC shall be obtained for the report formats.
- 1.17.12.8 Housekeeping Supervisor shall remain in his area most of the time and shall have information about agencies working/ material stacked in his area. Suitable control system may be devised for the same.
- 1.17.12.9 The Contractor shall be equipped to handle the special/emergency services even at short notice.
- 1.17.12.10 All equipment deployed shall be of quality standard.
- 1.17.12.11 Housekeeping Supervisor shall not allow those materials which affect the up keeping and fire hazards to building. Ex: wooden planks, drums, and scaffolding materials which are not painted.
- 1.17.13 **SANITATION / TOILET FACILITY AT WORK SITE**
- 1.17.13.1 Contractor shall establish toilet facility comprising of urinals and IWCs within the construction site along with water supply arrangements, disposal of waste, lighting, ventilation, washing facility, drainage arrangement, cleaning facility, etc., and shall maintain them in clean condition at all times by deploying suitable persons.
- 1.17.13.2 The numbers and the location of these toilet blocks shall be decided with the consent of Engineer and in line with GCC guidelines. As guidance, contractor may adopt the design of public toilet facilities provided by M/s. Sulabh International. For disposal of the sewage, NPCIL STP may be used.
- 1.17.14 **DISPOSAL OF WASTE AND DEBRIS**
- 1.17.14.1 During the execution of work, the Contractor shall keep the entire site in neat and tidy conditions always by proper housekeeping and stacking of construction materials at site and by removing all debris and waste material regularly, on day to day basis if necessary.
- 1.17.14.2 Contractor shall arrange suitable portable metallic storage bins to store construction materials at site. No material shall be allowed to be spread at site directly on roads /

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floors. All the garbage and waste material shall be disposed off regularly at the designated area as specified by the Engineer. The curing water shall be constantly removed from various areas / floors by adopting temporary dewatering scheme in the buildings and maintain the site in hygienic condition.

- 1.17.14.3 All soil, filth or other matter of an offensive nature taken out of any trench, sewer, rain, cesspool or other place shall not be deposited on the surface, but shall at once be carried away by contractor, from the site of work for suitable and proper disposal.

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1.18 TENTATIVE WEIGHT SCHEDULE SUMMARY FOR NUCLEAR REACTOR AUXILIARY WORKS IN KKNPP UNIT 3 & 4		
TYPE OF EQUIPMENT	UNIT-3	UNIT-4
Static	423	423
Rotary	266	266
SS - Pipe	541	541
SS - Pipe supports	266	266
CS - Pipe	75	75
CS - Pipe supports	32	32
Valves	130	130

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TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
1	90	SCHEDULE-D	1.1	UKA	KTC	KTC21BB001	Boran- Containing Water Collection Tank	2NPL	1	Kg	350	700	UKA, -7.250 MTR	STATIC
2	91	SCHEDULE-D	1.1	UKA	KTC	KTC22BB001	Boran- Containing Water Collection Tank	2NPL	1	Kg	350	700	UKA, -7.250 MTR	STATIC
3	92	SCHEDULE-D	1.1	UKA	KTC	KTC23BB001	Boran- Containing Water Collection Tank	2NPL	1	Kg	350	700	UKA, -7.250 MTR	STATIC
4	93	SCHEDULE-D	1.1	UKA	KTC	KTC24BB001	Boran- Containing Water Collection Tank	2NPL	1	Kg	350	700	UKA, -7.250 MTR	STATIC
5	106	SCHEDULE-D	1.2	UKA	JNA	JNA10AC001(A)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
6	107	SCHEDULE-D	1.2	UKA	JNA	JNA10AC001(B)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
7	108	SCHEDULE-D	1.2	UKA	JNA	JNA20AC001(A)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
8	109	SCHEDULE-D	1.2	UKA	JNA	JNA20AC001(B)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
9	110	SCHEDULE-D	1.2	UKA	JNA	JNA30AC001(A)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
10	111	SCHEDULE-D	1.2	UKA	JNA	JNA30AC001(B)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
11	112	SCHEDULE-D	1.2	UKA	JNA	JNA40AC001(A)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
12	113	SCHEDULE-D	1.2	UKA	JNA	JNA40AC001(B)	Emergency Cooling Hx	2NPL	1	Kg	7980	7980	UKA, -4.250 MTR	STATIC
13	114	SCHEDULE-D	1.1	UKA	KPM	KPM21BB001	Hydrolock Tank	2NPL	1	Kg	100	200	UKA, -4.250 MTR	STATIC
14	115	SCHEDULE-D	1.1	UKA	KPM	KPM22BB001	Hydrolock Tank	2NPL	1	Kg	100	200	UKA, -4.250 MTR	STATIC
15	116	SCHEDULE-D	1.2	UKA	KAA	KAA10AC001(A)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
16	117	SCHEDULE-D	1.2	UKA	KAA	KAA10AC001(B)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
17	118	SCHEDULE-D	1.2	UKA	KAA	KAA20AC001(A)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
18	119	SCHEDULE-D	1.2	UKA	KAA	KAA20AC001(B)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
19	120	SCHEDULE-D	1.2	UKA	KAA	KAA30AC001(A)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
20	121	SCHEDULE-D	1.2	UKA	KAA	KAA30AC001(B)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
21	122	SCHEDULE-D	1.2	UKA	KAA	KAA40AC001(A)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC

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22	123	SCHEDULE-D	1.2	UKA	KAA	KAA40AC001(B)	Component Water Cooling Hx	2NPL	1	Kg	5703	5703	UKA, -4.250 MTR	STATIC
23	137	SCHEDULE-D	1.1	UKA	LCQ	LCC61AT001	High Temperature Mechanical Filter	2NPL	1	Kg	5650	11300	UKA, -4.250 MTR	STATIC
24	138	SCHEDULE-D	1.1	UKA	LCQ	LCC62AT001	High Temperature Mechanical Filter	2NPL	1	Kg	5650	11300	UKA, -4.250 MTR	STATIC
25	139	SCHEDULE-D	1.1	UKA	LCQ	LCC63AT001	High Temperature Mechanical Filter	2NPL	1	Kg	5650	11300	UKA, -4.250 MTR	STATIC
26	140	SCHEDULE-D	1.1	UKA	LCQ	LCC64AT001	High Temperature Mechanical Filter	2NPL	1	Kg	5650	11300	UKA, -4.250 MTR	STATIC
27	141	SCHEDULE-D	1.1	UKA	LCQ	LCC61AT002	Mechanical Filter	2NPL	1	Kg	580	1160	UKA, -4.250 MTR	STATIC

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TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
28	142	SCHEDULE-D	1.1	UKA	LCQ	LCC62AT002	Mechanical Filter	2NPL	1	Kg	580	1160	UKA, -4.250 MTR	STATIC
29	143	SCHEDULE-D	1.1	UKA	LCQ	LCC63AT002	Mechanical Filter	2NPL	1	Kg	580	1160	UKA, -4.250 MTR	STATIC
30	144	SCHEDULE-D	1.1	UKA	LCQ	LCC64AT002	Mechanical Filter	2NPL	1	Kg	580	1160	UKA, -4.250 MTR	STATIC
31	145	SCHEDULE-D	1.1	UKA	LCQ	LCQ61AT004	High Temperature Mechanical Filter	2NPL	1	Kg	5	10	UKA, -4.250 MTR	STATIC
32	146	SCHEDULE-D	1.1	UKA	LCQ	LCQ62AT004	High Temperature Mechanical Filter	2NPL	1	Kg	5	10	UKA, -4.250 MTR	STATIC
33	147	SCHEDULE-D	1.1	UKA	LCQ	LCQ63AT004	High Temperature Mechanical Filter	2NPL	1	Kg	5	10	UKA, -4.250 MTR	STATIC
34	148	SCHEDULE-D	1.1	UKA	LCQ	LCQ64AT004	High Temperature Mechanical Filter	2NPL	1	Kg	5	10	UKA, -4.250 MTR	STATIC
35	149	SCHEDULE-D	1.2	UKA	KAA	KAA10AC002	Component Water Cooler Hx	2NPL	1	Kg	480	960	UKA, 0.00 MTR	STATIC
36	150	SCHEDULE-D	1.2	UKA	KAA	KAA20AC002	Component Water Cooler Hx	2NPL	1	Kg	480	960	UKA, 0.00 MTR	STATIC
37	151	SCHEDULE-D	1.2	UKA	KAA	KAA30AC002	Component Water Cooler Hx	2NPL	1	Kg	480	960	UKA, 0.00 MTR	STATIC
38	152	SCHEDULE-D	1.2	UKA	KAA	KAA40AC002	Component Water Cooler Hx	2NPL	1	Kg	480	960	UKA, 0.00 MTR	STATIC
39	153	SCHEDULE-D	1.1	UKB	KPM	KPM21AT001	Self-Clearing Filter	3N	1	Kg	210	420	UKB, 5.40mts+	STATIC
40	154	SCHEDULE-D	1.1	UKB	KPM	KPM21AT002	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
41	155	SCHEDULE-D	1.1	UKB	KPM	KPM21AT003	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
42	156	SCHEDULE-D	1.1	UKB	KPM	KPM21AT004	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
43	157	SCHEDULE-D	1.1	UKB	KPM	KPM21AT005	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

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44	158	SCHEDULE-D	1.1	UKB	KPM	KPM21AT006	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
45	159	SCHEDULE-D	1.1	UKB	KPM	KPM21AT007	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
46	160	SCHEDULE-D	1.1	UKB	KPM	KPM21AT008	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
47	161	SCHEDULE-D	1.1	UKB	KPM	KPM21AT009	Aerosol filter	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC
48	162	SCHEDULE-D	1.1	UKB	KPM	KPM21AT010	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
49	163	SCHEDULE-D	1.1	UKB	KPM	KPM21AT011	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
50	164	SCHEDULE-D	1.1	UKB	KPM	KPM21AT012	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
51	165	SCHEDULE-D	1.1	UKB	KPM	KPM21AT013	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
52	166	SCHEDULE-D	1.1	UKB	KPM	KPM21AT014	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
53	167	SCHEDULE-D	1.1	UKB	KPM	KPM21AT015	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
54	168	SCHEDULE-D	1.1	UKB	KPM	KPM21AT016	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
55	169	SCHEDULE-D	1.1	UKB	KPM	KPM21AT017	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
56	170	SCHEDULE-D	1.1	UKB	KPM	KPM21AT018	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
57	171	SCHEDULE-D	1.1	UKB	KPM	KPM21AT019	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
58	172	SCHEDULE-D	1.1	UKB	KPM	KPM21AT020	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
59	173	SCHEDULE-D	1.1	UKB	KPM	KPM21AT021	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
60	174	SCHEDULE-D	1.1	UKB	KPM	KPM21AT022	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
61	175	SCHEDULE-D	1.1	UKB	KPM	KPM21AT023	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
62	176	SCHEDULE-D	1.1	UKB	KPM	KPM21AT024	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
63	177	SCHEDULE-D	1.1	UKB	KPM	KPM21AT025	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
64	178	SCHEDULE-D	1.1	UKB	KPM	KPM21AT026	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
65	179	SCHEDULE-D	1.1	UKB	KPM	KPM21AT027	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

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66	180	SCHEDULE-D	1.1	UKB	KPM	KPM21AT028	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
67	181	SCHEDULE-D	1.1	UKB	KPM	KPM21AT029	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
68	182	SCHEDULE-D	1.1	UKB	KPM	KPM21AT030	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
69	183	SCHEDULE-D	1.1	UKB	KPM	KPM21AT031	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
70	184	SCHEDULE-D	1.1	UKB	KPM	KPM21AT032	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
71	185	SCHEDULE-D	1.1	UKB	KPM	KPM21AT033	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
72	186	SCHEDULE-D	1.1	UKB	KPM	KPM21AT034	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
73	187	SCHEDULE-D	1.1	UKB	KPM	KPM21AT035	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
74	188	SCHEDULE-D	1.1	UKB	KPM	KPM21AT036	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
75	189	SCHEDULE-D	1.1	UKB	KPM	KPM21AT037	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
76	190	SCHEDULE-D	1.1	UKB	KPM	KPM21AT038	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
77	191	SCHEDULE-D	1.1	UKB	KPM	KPM21AT039	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
78	192	SCHEDULE-D	1.1	UKB	KPM	KPM21AT040	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
79	193	SCHEDULE-D	1.1	UKB	KPM	KPM21AT041	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

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80	194	SCHEDULE-D	1.1	UKB	KPM	KPM21AC001	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC
81	195	SCHEDULE-D	1.1	UKB	KPM	KPM22AC001	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
82	196	SCHEDULE-D	1.1	UKB	KPM	KPM31AC001	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC
83	197	SCHEDULE-D	1.1	UKB	KPM	KPM31AT001	Self-Clearing Filter	3N	1	Kg	210	420	UKB, 5.40mts+	STATIC
84	198	SCHEDULE-D	1.1	UKB	KPM	KPM22AT001	Self-Clearing Filter	3N	1	Kg	210	420	UKB, 5.40mts+	STATIC
85	199	SCHEDULE-D	1.1	UKB	KPM	KPM22AT002	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
86	200	SCHEDULE-D	1.1	UKB	KPM	KPM22AT003	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
87	201	SCHEDULE-D	1.1	UKB	KPM	KPM22AT004	Zeolite Filter	3N	1	Kg	550	1100	UKB, 5.40mts+	STATIC
88	202	SCHEDULE-D	1.1	UKB	KPM	KPM22AT005	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
89	203	SCHEDULE-D	1.1	UKB	KPM	KPM22AT006	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
90	204	SCHEDULE-D	1.1	UKB	KPM	KPM22AT007	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
91	205	SCHEDULE-D	1.1	UKB	KPM	KPM22AT008	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
92	206	SCHEDULE-D	1.1	UKB	KPM	KPM22AT009	Aerosol filter	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC

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93	207	SCHEDULE-D	1.1	UKB	KPM	KPM22AT010	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
94	208	SCHEDULE-D	1.1	UKB	KPM	KPM22AT011	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
95	209	SCHEDULE-D	1.1	UKB	KPM	KPM22AT012	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
96	210	SCHEDULE-D	1.1	UKB	KPM	KPM22AT013	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
97	211	SCHEDULE-D	1.1	UKB	KPM	KPM22AT014	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
98	212	SCHEDULE-D	1.1	UKB	KPM	KPM22AT015	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
99	213	SCHEDULE-D	1.1	UKB	KPM	KPM22AT016	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
100	214	SCHEDULE-D	1.1	UKB	KPM	KPM22AT017	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
101	215	SCHEDULE-D	1.1	UKB	KPM	KPM22AT018	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
102	216	SCHEDULE-D	1.1	UKB	KPM	KPM22AT019	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
103	217	SCHEDULE-D	1.1	UKB	KPM	KPM22AT020	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
104	218	SCHEDULE-D	1.1	UKB	KPM	KPM22AT021	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
105	219	SCHEDULE-D	1.1	UKB	KPM	KPM22AT022	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
106	220	SCHEDULE-D	1.1	UKB	KPM	KPM22AT023	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

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107	221	SCHEDULE-D	1.1	UKB	KPM	KPM22AT024	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
108	222	SCHEDULE-D	1.1	UKB	KPM	KPM22AT025	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
109	223	SCHEDULE-D	1.1	UKB	KPM	KPM22AT026	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
110	224	SCHEDULE-D	1.1	UKB	KPM	KPM22AT027	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
111	225	SCHEDULE-D	1.1	UKB	KPM	KPM22AT028	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
112	226	SCHEDULE-D	1.1	UKB	KPM	KPM22AT029	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
113	227	SCHEDULE-D	1.1	UKB	KPM	KPM22AT030	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
114	228	SCHEDULE-D	1.1	UKB	KPM	KPM22AT031	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
115	229	SCHEDULE-D	1.1	UKB	KPM	KPM22AT032	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
116	230	SCHEDULE-D	1.1	UKB	KPM	KPM22AT033	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
117	231	SCHEDULE-D	1.1	UKB	KPM	KPM22AT034	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
118	232	SCHEDULE-D	1.1	UKB	KPM	KPM22AT035	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
119	233	SCHEDULE-D	1.1	UKB	KPM	KPM22AT036	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC

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120	234	SCHEDULE-D	1.1	UKB	KPM	KPM22AT037	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
121	235	SCHEDULE-D	1.1	UKB	KPM	KPM22AT038	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
122	236	SCHEDULE-D	1.1	UKB	KPM	KPM22AT039	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
123	237	SCHEDULE-D	1.1	UKB	KPM	KPM22AT040	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
124	238	SCHEDULE-D	1.1	UKB	KPM	KPM22AT041	Adsorbing Filter	3N	1	Kg	280	560	UKB, 5.40mts+	STATIC
125	239	SCHEDULE-D	1.1	UKB	KPM	KPM21AC002	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC
126	240	SCHEDULE-D	1.1	UKB	KPM	KPM22AC002	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC
127	241	SCHEDULE-D	1.1	UKB	KPM	KPM32AC001	Heat Exchanger	3N	1	Kg	459	918	UKB, 5.40mts+	STATIC
128	242	SCHEDULE-D	1.1	UKB	KPM	KPM32AT001	Self-Clearing Filter	3N	1	Kg	210	420	UKB, 5.40mts+	STATIC
129	243	SCHEDULE-D	1.1	UKB	KPM	KPM21AN001	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC
130	244	SCHEDULE-D	1.1	UKB	KPM	KPM21AN002	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC
131	245	SCHEDULE-D	1.1	UKB	KPM	KPM21AN003	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC
132	246	SCHEDULE-D	1.1	UKB	KPM	KPM31AH001	Electric Heater	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC
133	247	SCHEDULE-D	1.1	UKB	KPM	KPM31AH002	Electric Heater	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC

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134	248	SCHEDULE-D	1.1	UKB	KPM	KPM22AN001	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC
135	249	SCHEDULE-D	1.1	UKB	KPM	KPM22AN002	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
136	250	SCHEDULE-D	1.1	UKB	KPM	KPM22AN003	Gas Blower	3N	1	Kg	180	360	UKB, 5.40mts+	STATIC
137	251	SCHEDULE-D	1.1	UKB	KPM	KPM32AH001	Electric Heater	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC
138	252	SCHEDULE-D	1.1	UKB	KPM	KPM32AH002	Electric Heater	3N	1	Kg	230	460	UKB, 5.40mts+	STATIC
139	257	SCHEDULE-D	1.1	UFC	FCA	0FCA03AE501 0FCA03AE502	Fuel Assembly Gripper	2H	1	Kg	120.00	120.00	0.650+	STATIC
140	258	SCHEDULE-D	1.1	UFC	FCA	0FCJ03BB701	Transport Cask	2H	1	Kg	10600.0	10600.0	0.650+	STATIC
141	259	SCHEDULE-D	1.1	UFC	FCA	0FCJ03BB702	Transport Cask	2H	1	Kg	10600.0	10600.0	0.650+	STATIC
142	260	SCHEDULE-D	1.1	UFC	FCA	0FCJ03BB703	Transport Cask	2H	1	Kg	10600.0	10600.0	0.650+	STATIC
143	261	SCHEDULE-D	1.1	UFC	FCA	0FCJ03BB704	Transport Cask	2H	1	Kg	10600.0	10600.0	0.650+	STATIC
144	262	SCHEDULE-D	1.1	UFC	FCA	0FCJ03BB705	Transport Cask	2H	1	Kg	10600.0	10600.0	0.650+	STATIC
145	263	SCHEDULE-D	1.1	UFC	FCA	0FBA20AX501	Lig With Mimic	2H	1	Kg	1924.000	1924.000	0.650+	STATIC
146	264	SCHEDULE-D	1.1	UFC	FCA	0FCD01AE501	Shipping Cask Gripper (Grip Of The Leak Proof Bottle)	2H	1	Kg	165.000	165.000	0.650+	STATIC
147	265	SCHEDULE-D	1.1	UFC	FCA	0FCD04AE001	Cask Cross-Piece	2H	1	Kg	1200.0	1200.0	0.650+	STATIC
148	266	SCHEDULE-D	1.1	UFC	FCA	0FCD03AE001	Cluster Grip	2H	1	Kg	156.000	156.000	0.650+	STATIC
149	267	SCHEDULE-D	1.1	UFC	FCA	0FCD02AE061	Turner The Turning Angle Of The Frame Is 90	2H	1	Kg	4326.000	4326.000	0.650+	STATIC
150	268	SCHEDULE-D	1.1	UFC	FCA	0FAA20BB701 0FAA20BB702	Rack For Fa Simulators	2H	1	Kg	17000	17000	0.650+	STATIC

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151	269	SCHEDULE-D	1.1	UFC	FCA	0FAA10BB701	Rack For Fuel Assemblies	2H	1	Kg	18100.0	18100.0	0.650+	STATIC
152	270	SCHEDULE-D	1.1	UFC	FCA	0FAA10BB702 0FAA10BB703 0FAA10BB704		2H	1	Kg	63510.00	63510.00	0.650+	STATIC
153	271	SCHEDULE-D	1.1	UFC	FCA	0FAA30BB701	Rack For Bottles	2H	1	Kg	2100.0	2100.0	0.650+	STATIC
154	272	SCHEDULE-D	1.1	UFC	FCA	0FCJ02BB701	Cask For Bottles	2H	1	Kg	3600.0	3600.0	0.650+	STATIC
155	273	SCHEDULE-D	1.1	UFC	FCA	0FCF12AB031	Equipment Of New Fuel Storage Material Lock (Head)	2H	1	Kg	0	0	0.650+	STATIC
156	274	SCHEDULE-D	1.1	UFC	FCA	0FCF12AB031	Hatch	2H	1	Kg	25450.00	25450.00	0.650+	STATIC
157	275	SCHEDULE-D	1.1	UFC	FCA	0FCF12AB031	Sliding Gate	2H	1	Kg	42800.0	42800.0	0.650+	STATIC
158	276	SCHEDULE-D	1.1	UFC	FCA	0FCF12AB031	Swing Gate	2H	1	Kg	61090.00	61090.00	0.650+	STATIC
159	277	SCHEDULE-D	1.1	UFC	FCA	0FCF12AB031	Equipment Of New Fuel Storage Material Lock	2H	1	Kg	1465.000	1465.000	0.650+	STATIC
160	307	SCHEDULE-D	1.1	UKS	KPH	0KPH30AT001	Scrubber	3N Iib	1	Kg	1800	1800	4.8+	STATIC
161	308	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB001	Bubbler	3N Iib	1	Kg	1400	1400	3.660+	STATIC
162	309	SCHEDULE-D	1.1	UKS	KPH	0KPH20AV001	Burning Chamber With Gasket		1					STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
163	310	SCHEDULE-D	1.1	UKS	KPH	OKPH20AV001	Shutter 50Aa124	3N IIB	1	Kg	6390	6390	4.800+	STATIC
164	311	SCHEDULE-D	1.1	UKS	KPH	OKPH20AV001	Shutter 50Aa127		1					STATIC
165	312	SCHEDULE-D	1.1	UKS	KPH	OKPH20AV001	Shutter 50Aa128		1					STATIC
166	313	SCHEDULE-D	1.1	UKS	KPH	OKPH20AV001	Shutter 50Aa126		1					STATIC
167	314	SCHEDULE-D	1.1	UKS	KPH	OKPH20AV001	Plate		1					STATIC
168	315	SCHEDULE-D	1.1	UKS	KPH	OKPH20BB002	Trap	3N IIB	1	Kg	2040	2040	0.200+	STATIC
169	316	SCHEDULE-D	1.1	UKS	KPH	OKPH20BB003	Ash Unloading Box	3N IIB	1	Kg	700	700	2.100+	STATIC
170	317	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB003	Ash Measuring Tank	3N IIB	1	Kg	38	38	2.100+	STATIC
171	318	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB005	Cement Measuring Tank	4 III	1	Kg	380	380	1.900+	STATIC
172	319	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB007	Additives (Clay) Measuring Tank	4 III	1	Kg	150	150	1.900+	STATIC
173	320	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB008	Ash Grouting Box	3N IIB	1	Kg	2200	2200	0.0+	STATIC
174	321	SCHEDULE-D	1.1	UKS	KPH	OKPH30BB001	Receiver	3N IIB	1	Kg	1200	1200	0.190-	STATIC
175	322	SCHEDULE-D	1.1	UKS	KPH	OKPH40AT003	Filter Fartos	3N IIB	1	Kg	160	160	9.450+	STATIC
176	323	SCHEDULE-D	1.1	UKS	KPH	OKPH40AT004	Filter Fartos	3N IIB	1	Kg	160	160	9.450+	STATIC
177	324	SCHEDULE-D	1.1	UKS	KPH	OKPH40AT005	Filter Fartos	3N IIB	1	Kg	160	160	9.450+	STATIC
178	325	SCHEDULE-D	1.1	UKS	KPH	OKPH40AT006	Filter Fartos	3N IIB	1	Kg	160	160	9.450+	STATIC
179	326	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB001	Buffer Tank	3N IIB	1	Kg	1300	1300	0.200+	STATIC
180	327	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB002	Solution Measuring Tank	3N IIB	1	Kg	120	120	6.250+	STATIC
181	328	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB004	Cement Loading Pocket With Hose Filter	4 III	1	Kg	1160	1160	4.800+	STATIC
182	329	SCHEDULE-D	1.1	UKS	KPH	OKPH60BB006	Additive Clay Loading Pocket	4 III	1	Kg	260	260	4.800+	STATIC
183	330	SCHEDULE-D	1.1	UKS	KPH	OKPH60AT001	Filter Dn 200	3N IIB	1	Kg	110	110	4.800+	STATIC

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184	331	SCHEDULE-D	1.1	UKS	KPH	0KPH30BB002	Tank Of Reserved Water	4 III	1	Kg	460	460	8.800+	STATIC
185	332	SCHEDULE-D	1.1	UKS	KPH	0KPH30BB003	Alkali Solution Tank	4 III	1	Kg	720	720	4.800+	STATIC
186	333	SCHEDULE-D	1.1	UKS	KPH	0KPH30CQ001	Gas Sampler	4 III	1	Kg	80	80	4.800+	STATIC
187	334	SCHEDULE-D	1.1	UKS	KPH	0KPH30CQ002	Gas Sampler	4 III	1	Kg	80	80	8.800+	STATIC
188	335	SCHEDULE-D	1.1	UKS	KPH	0KPH30AT002	Cyclone- Moisture Seperator	3N IIb	1	Kg	290	290	4.800+	STATIC
189	336	SCHEDULE-D	1.1	UKS	KPH	0KPH40AC001	Re-Heater	3N IIb	1	Kg	500	500	4.800+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
190	337	SCHEDULE-D	1.1	UKS	KPH	0KPH30AC001	Re-Heater	3N Ilb	1	Kg	2200	2200	4.800+	STATIC
191	338	SCHEDULE-D	1.1	UKS	KPH	0KPH40AT002	Re-Heater(Hose Filter With Box)	3N Ilb	1	Kg	180	180	4.800+	STATIC
192	339	SCHEDULE-D	1.1	UKS	KPH	0KPH40AC002	Re-Heater	3N Ilb	1	Kg	500	500	4.800+	STATIC
193	340	SCHEDULE-D	1.1	UKS	KPH	0KPH40AT001	Re-Heater(Hose Filter With Box)	3N Ilb	1	Kg	1550	1550	4.800+	STATIC
194	341	SCHEDULE-D	1.1	UKS	KPH	0KPH60AT002	Filter Fartos	3N Ilb	1	Kg	160	160	9.450+	STATIC
195	342	SCHEDULE-D	1.1	UKS	KPH	0KPH	Srw Incineration Plant Refractory Brick		1	Kg	14207	14207	4.800+	STATIC
196	343	SCHEDULE-D	1.1	UKS	KPH	NO KKS	Site(Platform)	4 III	1	Kg	2000	2000	1.900+	STATIC
197	344	SCHEDULE-D	1.1	UKS	KPH	NO KKS	Site(Platform)	4 III	1	Kg	1750	1750	2.100+	STATIC
198	345	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BR030	Gas Duct (Gas Flue)	3N Ilb	1	Kg	250	250	3.700+	STATIC
199	346	SCHEDULE-D	1.1	UKS	KPH	0 KPH60CQ001	Dust Cleaning Device	3N Ilb	1	Kg	26	26	4.800+	STATIC
200	347	SCHEDULE-D	1.1	UKS	KPH	0 KPH60CQ002	Dust Cleaning Device	3N Ilb	1	Kg	30	30	8.800+	STATIC
201	348	SCHEDULE-D	1.1	UKS	KPH	0KPH10BB001	Diesel Fuel Tank	4 III	1	Kg	890	890	0.450+	STATIC
202	349	SCHEDULE-D	1.1	UKS	KPH	0 KPH	Refractory Items	3N Ilb	1	Kg	14482	14482	4.800+	STATIC
203	350	SCHEDULE-D	1.1	UKS	KPH	0 KPH	Refractory Items	3N Ilb	1	Kg	9948	9948	4.800+	STATIC
204	351	SCHEDULE-D	1.1	UKS	KPH	0 KPH10	Pipeline Valve Set	4 III	1	Kg	2	2.1	4.800+	STATIC
205	352	SCHEDULE-D	1.1	UKS	KPH	0 KPH20AB001	Loading Unit	3N Ilb	1	Kg	1615	1615	8.870+	STATIC
206	353	SCHEDULE-D	1.1	UKS	KPH	0 KPH20AB001	Shutter 65	4 III	1	Kg	2	2	0.250+	STATIC
207	354	SCHEDULE-D	1.1	UKS	KPH	0 KPH20AB001	Shutter 50	4 III	1	Kg	2	2	0.250+	STATIC
208	355	SCHEDULE-D	1.1	UKS	KPH	0 KPH20	Burner Nozzle	3N Ilb	1	Kg	1190	1190	4.800+	STATIC
209	356	SCHEDULE-D	1.1	UKS	KPH	0 KPH10AT001	Fuel Filter	3N Ilb	1	Kg	2.37	2.37	0.525+	STATIC
210	357	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BR001	Gas Flue	3N Ilb	1	Kg	752	752	3.700+	STATIC

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211	358	SCHEDULE-D	1.1	UKS	KPH	0KPH20AV002	Cover(After Combustion Chamber)	3N I Ib	1	Kg	520	520	4.800+	STATIC
212	359	SCHEDULE-D	1.1	UKS	KPH	0KPH20AV002	Body(Frame)	3N I Ib	1	Kg	3890	3890	4.800+	STATIC
213	360	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/1	Container	3N I Ib	1				0.0+	STATIC
214	361	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/2	Container	3N I Ib	1				0.0+	STATIC
215	362	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/3	Container	3N I Ib	1				0.0+	STATIC
216	363	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/4	Container	3N I Ib	1				0.0+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
217	364	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/5	Container	3N Ilb	1	Kg	2410	2410	0.0+	STATIC
218	365	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/6	Container	3N Ilb	1				0.0+	STATIC
219	366	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/7	Container	3N Ilb	1				0.0+	STATIC
220	367	SCHEDULE-D	1.1	UKS	KPH	0KPH20BB004/8	Container	3N Ilb	1				0.0+	STATIC
221	368	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BB004/9	Container	3N Ilb	1				0.0+	STATIC
222	369	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BB004/1 0	Container	3N Ilb	1				0.0+	STATIC
223	370	SCHEDULE-D	1.1	UKS	KPH	0 KPH20AE001	Turn Over Device	4 III	1	Kg	110	110	8.800+	STATIC
224	371	SCHEDULE-D	1.1	UKS	KPH	0 KPH40AT001	Receiver	3N Ilb	1	Kg	320	320	4.800+	STATIC
225	372	SCHEDULE-D	1.1	UKS	KPH	0 KPH40AT002	Receiver	3N Ilb	1	Kg	320	320	4.800+	STATIC
226	373	SCHEDULE-D	1.1	UKS	KPH	0 KPH40BB001	Box	3N Ilb	1	Kg	193	193	1.830+	STATIC
227	374	SCHEDULE-D	1.1	UKS	KPH	0 KPH40BB002	Box	3N Ilb	1	Kg	193	193	1.830+	STATIC
228	375	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BB002	Trap Connection	3N Ilb	1	Kg	250	250	7810+	STATIC
229	376	SCHEDULE-D	1.1	UKS	KPH	0 KPH20BB002	Trap Pipe	3N Ilb	1	Kg	100	100	7810+	STATIC
230	377	SCHEDULE-D	1.1	UKS	KPH	0 KPH60CQ003	Elutriating Device	3N Ilb	1	Kg	248	248	4.800+	STATIC
231	378	SCHEDULE-D	1.1	UKS	KPH	0 KPH60CQ004	Washing Device	3N Ilb	1	Kg	26	26	8.800+	STATIC
232	379	SCHEDULE-D	1.1	UKS	KPH	0 KPH60AE001	Capture	3N Ilb	1	Kg	136	136	4.800+	STATIC
233	380	SCHEDULE-D	1.1	UKS	KPH	0 KPH	Valves	4 III	1	Kg	2440	2440	0.0,4.8,8.8	STATIC
234	381	SCHEDULE-D	1.1	UKS	KPH	0 KPH56AT001	Air Purifier		1	Kg	4500	4500		STATIC
235	382	SCHEDULE-D	1.1	UKS	KPH	0KPH20AV003	Equipment Cabinet	3N Ilb	1	Kg	76	76	8.780+	STATIC
236	383	SCHEDULE-D	1.1	UKS	KPH	0 KPH14AT002	Let-Out		1	Kg	4500	4500		STATIC
237	384	SCHEDULE-D	1.1	UKS	KPH	NO KKS	Table For Sampling	3N Ilb	1	Kg	100	100	4.800+	STATIC

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238	385	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB001	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
239	386	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB002	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
240	387	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB003	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
241	388	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB004	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
242	389	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB005	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
243	390	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB006	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
244	391	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB007	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
245	392	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB008	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
246	393	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB009	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
247	394	SCHEDULE-D	1.1	UKS	KPA	0 KPA40BB010	Container For Solid Radioactive Wasters, Radiation Activity Group I	4 III	1	Kg	320	320	0.0+	STATIC
248	395	SCHEDULE-D	1.1	UKS	KPA	0 KPA50AP001	Hydraulic Actuator	4 III	1	Kg	750	1500	0.0+	STATIC
249	396	SCHEDULE-D	1.1	UKS	KPA	0 KPA10BB001	Loading Pocket	4 III	1	Kg	510	1020	0.840+	STATIC
250	397	SCHEDULE-D	1.1	UKS	KPA	0 KPA10BB002	Grading Unit(Packing Box)	4 III	1	Kg	3300	3300	0.840+	STATIC
251	398	SCHEDULE-D	1.1	UKS	KPA	0KPA10AF001	Grading Unit(Feeder)	4 III	1			0		STATIC
252	399	SCHEDULE-D	1.1	UKS	KPA	0KPA10AK001	Grading Unit(Grading Box)	4 III	1			0		STATIC
253	400	SCHEDULE-D	1.1	UKS	KPA	0KPA10AK002	Disc Gate Valve Dn 100	4 III	1			0		STATIC
254	401	SCHEDULE-D	1.1	UKS	KPA	0KPA10AE001	Grading Unit(Carriage)	4 III	1			0		STATIC
255	402	SCHEDULE-D	1.1	UKS	KPA	0KPA10AW001	Platform	4 III	1	Kg	925.000	925	0.0+	STATIC
256	403	SCHEDULE-D	1.1	UKS	KPA	0KPA60AT001	Mechanical Filter	4 III	1	Kg	75	75	0.0+	STATIC
257	404	SCHEDULE-D	1.1	UKS	KPA	0KPA60AT002	Mechanical Filter	4 III	1	Kg	75	75	0.0+	STATIC
258	405	SCHEDULE-D	1.1	UKS	KPA	0KPA50AK001	Press Unit(Press Kh)	3H IIb	1					STATIC

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259	406	SCHEDULE-D	1.1	UKS	KPA	0KPA50AK002	Press	3H IIb	1					STATIC
260	407	SCHEDULE-D	1.1	UKS	KPA	0KPA50AE001	Press Unit(Trolley)		1					STATIC
261	408	SCHEDULE-D	1.1	UKS	KPA	0KPA50AE003	Press Unit(Takeup)	3H IIb	1					STATIC
262	409	SCHEDULE-D	1.1	UKS	KPA	0KPA50AE002	Press Unit(Actuator Of Trolley Removal)	3H IIb	1					STATIC
263	410	SCHEDULE-D	1.1	UKS	KPA	0KPA50KK001	Cover Removing & Pressing	3H IIb	1					STATIC
264	411	SCHEDULE-D	1.1	UKS	KPA	0KPA50AT001	Press Unit(Dust Catcher)	3H IIb	1	Kg	13500	13500	0.0+	STATIC
265	412	SCHEDULE-D	1.1	UKS	KPA	0KPA50AB701	Peephole	3H IIb	1	Kg	150	150		STATIC
266	413	SCHEDULE-D	1.1	UKS	KPA	0KPA50AB001	Gate	3H IIb	1	Kg	900	900	2.350+	STATIC
267	414	SCHEDULE-D	1.1	UKS	KPA	0KPA50AB002	Gate	3H IIb	1	Kg	900	900	2.350+	STATIC
268	415	SCHEDULE-D	1.1	UKS	KPA	0KPA50AP001	Hydraulic Actuator	4 III	1	Kg	1500	1500	0.0+	STATIC
269	416	SCHEDULE-D	1.1	UKS	KPF	0 KPF70AT004	Breathing Valve Dn 150 (Without Flame Arrester)	4 III	1	Kg	115	115	0.115+	STATIC
270	417	SCHEDULE-D	1.1	UKS	KPF	0 KPF70AT003	Breathing Mechanical Valve Dn 50 (Without Flame Arrester)	4 III	1	Kg	8	8	0.115+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
271	418	SCHEDULE-D	1.1	UKS	KPF	0KPF71BB001	Drain Water Tank	3H IIb	1	Kg	1250	1250	0.300+	STATIC
272	419	SCHEDULE-D	1.1	UKS	KPF	0KPF72AT001	Filter With A Capacity Of 200 M3/H; Working Pressure In The Case (Gage) - 0.25 Mpa; Working Temperature - Up To 100	4 III	1	Kg	202	202	0.560+	STATIC
273	420	SCHEDULE-D	1.1	UKS	KPF	0KPF70BB001	Tank Of Drain Water Sump	3H IIb	1	Kg	500	500	1.450-	STATIC
274	421	SCHEDULE-D	1.1	UKS	KPE	0 KPE10BB	Barrel					0		STATIC
275	422	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE001	Equipment Set For Controlled Storage Of Srw Of Active Group Iii, Including: Reloading Station, Caps Loading Station,						13.2+	STATIC
276	423	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE002	Plate Conductor						13.2+	STATIC
277	424	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE004	Reducing Ring (Adapting Ring)						13.2+	STATIC
278	425	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE005	Load Transferring Device						13.2+	STATIC
279	426	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE006	Capsule Casing Holding Device						13.2+	STATIC
280	427	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE007	Plugs Draw Hook (Plug Removal)						13.2+	STATIC
281	428	SCHEDULE-D	1.1	UKS	KPE	0 KPE20AE008	Pole						13.2+	STATIC
282	429	SCHEDULE-D	1.1	UKS	KPE	0 KPE10BB001	Shielding Container For Barrels With Srw Of Activity Group Ii;						13.2+	STATIC
283	430	SCHEDULE-D	1.1	UKS	KPE	0KPE10BB002			1	Kg	3717	3717	13.2+	STATIC
284	431	SCHEDULE-D	1.1	UKS	KPE	0KPE10BB003			1	Kg	3717	3717	13.2+	STATIC
285	432	SCHEDULE-D	1.1	UKS	KPE	0 KPE10AE001	Door (Protective Container For Casks)		1	Kg	1550	1550	13.2+	STATIC
286	433	SCHEDULE-D	1.1	UKS	KPE	0 KPE10BB01	Barrel		1	Kg	1440	1440	13.2+	STATIC

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287	434	SCHEDULE-D	1.1	UKS	KPE	0 KPE50BB01	Barrel	3N IIb	1	Kg	2160	2160	13.2+	STATIC
288	435	SCHEDULE-D	1.1	UKS	KPE	0KPE20BB001	Nfmc Capsule		1	Kg	952	952	13.2+	STATIC
289	436	SCHEDULE-D	1.1	UKS	KPE	0KPE30BB001	Ich Capsule		1	Kg	972	972	13.2+	STATIC
290	437	SCHEDULE-D	1.1	UKS	KPE	0 KPE50BB02	Barrel		1	Kg	3600	3600	13.2+	STATIC
291	438	SCHEDULE-D	1.1	UKS	KPE	0KPE40BB	Barrel For Solified Raw		1	Kg	132	132	13.2+	STATIC
292	439	SCHEDULE-D	1.1	UKS	KPP	0KPP10BB001	Case Of Boxing 1	4 III	1	Kg	1750	3500	0.0+	STATIC
293	440	SCHEDULE-D	1.1	UKS	KPP	0KPP10AJ001	Guillotine	4 III	1				0.0+	STATIC
294	441	SCHEDULE-D	1.1	UKS	KPP	0KPP10BB002	Case Of Boxing 1	4 III	1	Kg	0	0	0.0+	STATIC
295	442	SCHEDULE-D	1.1	UKS	KPP	0KPP10KK001	Device For Cover Removal & Pressing	4 III	1	Kg	365	365	0.0+	STATIC
296	443	SCHEDULE-D	1.1	UKS	KPP	0KPP10AE001	Carriage(Trolley)	4 III	1	Kg	210.000	210	0.0+	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
297	444	SCHEDULE-D	1.1	UKS	KPP	0KPP10KA002	Disc Shutter Dn 100	4 III	1	Kg	2.63	2.63	0.0+	STATIC
298	445	SCHEDULE-D	1.1	UKC	LCQ	LCQ73AT001	Trap Filter	QA3	1	Kg	600	1200	-3.650	STATIC
299	446	SCHEDULE-D	1.1	UKC	LCQ	LCQ73AT002	Trap Filter	QA3	1	Kg	600	1200	-3.650	STATIC
300	447	SCHEDULE-D	1.1	UKC	LCQ	LCQ77AT001	Trap Filter	QA3	1	Kg	600	1200	-3.650	STATIC
301	448	SCHEDULE-D	1.1	UKC	LCQ	LCQ77AT002	Trap Filter	QA3	1	Kg	600	1200	-3.650	STATIC
302	449	SCHEDULE-D	1.1	UKC	KBF	KBF50AT004	Catcher Filter	QA3	1	Kg	157	314	-3.650	STATIC
303	450	SCHEDULE-D	1.1	UKC	KUE	KUE20AT001	Sampling Chamber	QA3	1	Kg	80	160	-3.650	STATIC
304	451	SCHEDULE-D	1.1	UKC	KUE	KUE70AT001	Sampling Chamber	QA3	1	Kg	80	160	-3.650	STATIC
305	452	SCHEDULE-D	1.1	UKC	KPM	KPM40BB001	Hydroseal Tank	QA3	1	Kg	180	360	-3.650	STATIC
306	453	SCHEDULE-D	1.1	UKC	LCQ 10	LCL61AC001	Sg Drain Cooling	QA3	1	Kg	510	1020	-3.650	STATIC
307	454	SCHEDULE-D	1.1	UKC	LCM	LCM81AC001	Condensate Cooler	QA3	1	Kg	230	460	-3.650	STATIC
308	455	SCHEDULE-D	1.1	UKC	QUH	QUH10AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
309	456	SCHEDULE-D	1.1	UKC	QUH	QUH10AC002	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
310	457	SCHEDULE-D	1.1	UKC	QUH	QUH10AC003	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
311	458	SCHEDULE-D	1.1	UKC	QUH	QUH10AC004	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
312	459	SCHEDULE-D	1.1	UKC	QUH	QUH10AC005	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
313	460	SCHEDULE-D	1.1	UKC	QUH	QUH10AC006	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
314	461	SCHEDULE-D	1.1	UKC	QUH	QUH10AC007	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
315	462	SCHEDULE-D	1.1	UKC	QUH	QUH10AC008	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-3.650	STATIC
316	463	SCHEDULE-D	1.1	UKC	LCM	LCM80BB001	Hot Well	QA3	1	Kg	132	264	-0.050	STATIC
317	464	SCHEDULE-D	1.1	UKC	LCM	LCM80BB002	Hot Well	QA3	1	Kg	132	264	-0.050	STATIC

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318	465	SCHEDULE-D	1.1	UKC	KBH	KBH14AT001	Ionites Trap	QA3	1	Kg	407	814	-0.050	STATIC
319	466	SCHEDULE-D	1.1	UKC	KUA	KUA10AT001	Sampling Chambers	QA3	1	Kg	80	160	-0.050	STATIC
320	467	SCHEDULE-D	1.1	UKC	KUA	KUA20AT001	Sampling Chambers	QA3	1	Kg	80	160	-0.050	STATIC
321	468	SCHEDULE-D	1.1	UKC	KUA	KUA30AT001	Sampling Chambers	QA3	1	Kg	80	160	-0.050	STATIC
322	469	SCHEDULE-D	1.1	UKC	KUA	KUA40AT001	Sampling Chambers	QA3	1	Kg	80	160	-0.050	STATIC
323	470	SCHEDULE-D	1.1	UKC	KUA	KUA14AT004	Measuring Chamber	QA3	1	Kg	175	350	-0.050	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
324	471	SCHEDULE-D	1.1	UKC	KUA	KUA15AT004	Measuring Chamber	QA3	1	Kg	175	350	-0.050	STATIC
325	472	SCHEDULE-D	1.1	UKC	KUA	KUA16AT004	Measuring Chamber	QA3	1	Kg	175	350	-0.050	STATIC
326	473	SCHEDULE-D	1.1	UKC	KBF	KBF50AC001	Boric Concentration Cooler	QA3	1	Kg	473	945	-0.050	STATIC
327	474	SCHEDULE-D	1.1	UKC	KUA	KUA21AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
328	475	SCHEDULE-D	1.1	UKC	KUA	KUA22AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
329	476	SCHEDULE-D	1.1	UKC	KUA	KUA23AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
330	477	SCHEDULE-D	1.1	UKC	KUA	KUA30AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
331	478	SCHEDULE-D	1.1	UKC	KUA	KUA31AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
332	479	SCHEDULE-D	1.1	UKC	KUA	KUA40AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
333	480	SCHEDULE-D	1.1	UKC	KUA	KUA40AC002	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
334	481	SCHEDULE-D	1.1	UKC	KUA	KUA40AC003	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
335	482	SCHEDULE-D	1.1	UKC	KUA	KUA40AC004	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
336	483	SCHEDULE-D	1.1	UKC	KUE	KUE10AC009	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	-0.050	STATIC
337	484	SCHEDULE-D	1.1	UKC	KUE	KUE10AC010	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	+3.550	STATIC
338	485	SCHEDULE-D	1.1	UKC	KUE	KUE10AC013	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	+3.550	STATIC
339	486	SCHEDULE-D	1.1	UKC	KBA	KBA22AC001	Makeup Water Aftercooler	QA3	1	Kg	460	920	+3.550	STATIC
340	487	SCHEDULE-D	1.1	UKC	KUE	KUE10AC001	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	+3.550	STATIC
341	488	SCHEDULE-D	1.1	UKC	KUE	KUE10AC002	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	+3.550	STATIC
342	489	SCHEDULE-D	1.1	UKC	KUE	KUE10AC003	Sampling Heat Exchanger	QA3	1	Kg	22	44.2	+3.550	STATIC
343	490	SCHEDULE-D	1.1	UKC	KBF	KBF50AT005	Air Bleeder	QA3	1	Kg	80	160	+3.550	STATIC
344	491	SCHEDULE-D	1.1	UKC	KPF	KPF40AT002	Catcher Filter	QA3	1	Kg	140	280	+3.550	STATIC

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345	492	SCHEDULE-D	1.1	UKC	KUE	KUE10AT001	Sampling Chamber	QA3	1	Kg	80	160	+3.550	STATIC
346	493	SCHEDULE-D	1.1	UKC	KUE	KUE80AT001	Sampling Chamber	QA3	1	Kg	80	160	+3.550	STATIC
347	494	SCHEDULE-D	1.1	UKC	KBE	KBE60AT001	Air Vents Box	QA3	1	Kg	80	160	+3.550	STATIC
348	495	SCHEDULE-D	1.1	UKC	KPF	KPF30AT007	Filter Trap	QA3	1	Kg	140	280	+3.550	STATIC
349	496	SCHEDULE-D	1.1	UKC	KUA	KUA70AX001	Set Of Equipment Of Preparing Samples Plant For Radio- Active Sampling System	QA3	1	Kg	866	1732	+3.550	STATIC
350	497	SCHEDULE-D	1.1	UKC	KUA	KUA80AX001	Set Of Equipment Of Preparing Samples Plant For Radio- Active Sampling System	QA3	1	Kg	866	1732	+3.550	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT

Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.

(2) The quantities of KKNPP Unit-3&4 is subject to change.

S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
351	498	SCHEDULE-D	1.1	UKC	KPL	KPL10BB003	Hydraulic Lock Tank	QA3	1	Kg	201	402	+3.550	STATIC
352	499	SCHEDULE-D	1.1	UKC	FKT	FKT40AC001	Heater	QA3	1	Kg	170	340	+7.150	STATIC
353	500	SCHEDULE-D	1.1	UKC	FKT	FKT50AC001	Heater	QA3	1	Kg	300	600	+7.150	STATIC
354	501	SCHEDULE-D	1.1	UKC	FKT	FKT60AC001	Heater	QA3	1	Kg	170	340	+7.150	STATIC
355	502	SCHEDULE-D	1.1	UKC	KPF	KPF11AT001	Hydraulic Cyclone	QA3	1	Kg	1400	2800	+7.150	STATIC
356	503	SCHEDULE-D	1.1	UKC	KPF	KPF11AT002	Hydraulic Cyclone	QA3	1	Kg	1400	2800	+7.150	STATIC
357	504	SCHEDULE-D	1.1	UKC	KBH	KBH16AT001	Air Bleeder Box	QA3	1	Kg	80	160	+7.150	STATIC
358	505	SCHEDULE-D	1.1	UKC	KBF	KBF30AT004	Catcher Filter	QA3	1	Kg	140	280	+7.150	STATIC
359	506	SCHEDULE-D	1.1	UKC	QUK	QUK10AX001	Samples And Measuring Preparation System	QA3	1	Kg	136	272	+7.150	STATIC
360	507	SCHEDULE-D	1.1	UKC	QUK	QUK20AX001	Samples And Measuring Preparation System	QA3	1	Kg	136	272	+7.150	STATIC
361	508	SCHEDULE-D	1.1	UKC	QUK	QUK30AX001	Samples And Measuring Preparation System	QA3	1	Kg	136	272	+7.150	STATIC
362	509	SCHEDULE-D	1.1	UKC	QUK	QUK40AX001	Samples And Measuring Preparation System	QA3	1	Kg	136	272	+7.150	STATIC
363	510	SCHEDULE-D	1.1	UKC	QUK	QUK50AX001	Samples And Measuring Preparation System	QA3	1	Kg	186	372	+7.150	STATIC
364	511	SCHEDULE-D	1.1	UKC	QUK	QUK60AX001	Samples And Measuring Preparation System	QA3	1	Kg	186	372	+7.150	STATIC
365	512	SCHEDULE-D	1.1	UKC	QUK	QUK70AX001	Samples And Measuring Preparation System	QA3	1	Kg	186	372	+7.150	STATIC
366	513	SCHEDULE-D	1.1	UKC	QUK	QUK80AX001	Samples And Measuring Preparation System	QA3	1	Kg	186	372	+7.150	STATIC
367	514	SCHEDULE-D	1.1	UKC	KPL	KPL10AC001	Vapour Condenser	QA3	1	Kg	255	510	+14.350	STATIC
368	515	SCHEDULE-D	1.1	UKC	KPL	KPL10AC002	Gases Cooler	QA3	1	Kg	455	910	+14.350	STATIC
369	516	SCHEDULE-D	1.1	UKC	KPL	KPL10AC003	Gases Cooler	QA3	1	Kg	455	910	+14.350	STATIC
370	517	SCHEDULE-D	1.1	UKC	JEA	JEA71AC001	Sample Cooler	QA3	1	Kg	25	50	+14.350	STATIC
371	518	SCHEDULE-D	1.1	UKC	JEA	JEA72AC002	Sample Cooler	QA3	1	Kg	25	50	+14.350	STATIC

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372	519	SCHEDULE-D	1.1	UKC	JEA	JEA73AC003	Sample Cooler	QA3	1	Kg	25	50	+14.350	STATIC
373	520	SCHEDULE-D	1.1	UKC	JEA	JEA74AC004	Sample Cooler	QA3	1	Kg	25	50	+14.350	STATIC
374	521	SCHEDULE-D	1.1	UKC	JEA	JEA90AC001	Sample Cooler	QA3	1	Kg	25	50	+14.350	STATIC
375	522	SCHEDULE-D	1.1	UKC	KPM	KPM41AC001	Cooler Of Gases	QA3	1	Kg	845	1690	+14.350	STATIC
376	523	SCHEDULE-D	1.1	UKC	KPM	KPM42AC001	Cooler Of Gases	QA3	1	Kg	845	1690	+14.350	STATIC
377	524	SCHEDULE-D	1.1	UKC	KPM	KPM41AT002	Iodic Filter Absorber	QA3	1	Kg	390	780	+14.350	STATIC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF STATIC EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
S.no	Cust Ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
378	525	SCHEDULE-D	1.1	UKC	KPM	KPM42AT002	Iodic Filter Absorber	QA3	1	Kg	390	780	+14.350	STATIC
379	526	SCHEDULE-D	1.1	UKC	KPM	KPM41AT001	Aerosol Filter Fartos Ts-500	QA3	1	Kg	202	404	+14.350	STATIC
380	527	SCHEDULE-D	1.1	UKC	KPM	KPM42AT001	Aerosol Filter Fartos Ts-500	QA3	1	Kg	202	404	+14.350	STATIC
381	528	SCHEDULE-D	1.1	UKC	KPM	KPM41AH001	Electric Heater	QA3	1	Kg	100	200	+14.350	STATIC
382	529	SCHEDULE-D	1.1	UKC	KPM	KPM42AH001	Electric Heater	QA3	1	Kg	100	200	+14.350	STATIC
383	530	SCHEDULE-D	1.1	UKC	KPN	KPN10BB008	Buffer Tank	QA3	1	Kg	450	900	-3.650	STATIC
384	531	SCHEDULE-D	1.1	UKC	KPC	KPC 16	Flushing And Decontamination Unit	QA3	1	Kg	400	800	-3.650	STATIC
385	532	SCHEDULE-D	1.1	UKC	KPN	KPN10BB006	Header	QA3	1	Kg	30	60	-0.050	STATIC
386	533	SCHEDULE-D	1.1	UKC	KPN	KPN10AX001	Sampling Box	QA3	1	Kg	540	1080	-0.050	STATIC
387	534	SCHEDULE-D	1.1	UKC	KPN	KPN10BB003	Sorbents Metering Tank	QA3	1	Kg	290	580	-0.050	STATIC
388	535	SCHEDULE-D	1.1	UKC	KPN	KPN10BB007	Vrc Metering Tank	QA3	1	Kg	275	550	-0.050	STATIC
389	536	SCHEDULE-D	1.1	UKC	KPN	KPE10AB201	Gate	QA3	1	Kg	1580	3160	+3.550	STATIC
390	537	SCHEDULE-D	1.1	USF	KRA	KRA10BB001	Nitrogen Receiver	QA3	1	Kg	14320	28640	-0.050	STATIC
391	538	SCHEDULE-D	1.1	USF	KRA	KRA11BB001	Nitrogen Receiver	QA3	1	Kg	14320	28640	-0.050	STATIC
392	539	SCHEDULE-D	1.1	USC	QFA	QFA11BB001	Compressed Air Received	QA3	1	Kg	14600	29200	-0.050	STATIC
393	540	SCHEDULE-D	1.1	USC	QFA	QFA12BB001	Compressed Air Received	QA3	1	Kg	14600	29200	-0.050	STATIC
TOTAL WEIGHT (in KG)											703919	844749		
TOTAL WEIGHT (in MT)											704	845		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
1	74	SCHEDULE-D	1.4	UKA	JNA	JNA10AP001	Emergency Pool Cooling Pump	2NPL	1	Kg	10980	21960	UKA, -7.250 MTR	ROTARY
2	75	SCHEDULE-D	1.4	UKA	JNA	JNA20AP001	Emergency Pool Cooling Pump	2NPL	1	Kg	10980	21960	UKA, -7.250 MTR	ROTARY
3	76	SCHEDULE-D	1.4	UKA	JNA	JNA30AP001	Emergency Pool Cooling Pump	2NPL	1	Kg	10980	21960	UKA, -7.250 MTR	ROTARY
4	77	SCHEDULE-D	1.4	UKA	JNA	JNA40AP001	Emergency Pool Cooling Pump	2NPL	1	Kg	10980	21960	UKA, -7.250 MTR	ROTARY
5	78	SCHEDULE-D	1.3	UKA	JNA	JNA10BN001	Jet Pump	2NPL	1	Kg	35	70	UKA, -7.250 MTR	ROTARY
6	79	SCHEDULE-D	1.3	UKA	JNA	JNA10BN002	Jet Pump	2NPL	1	Kg	35	70	UKA, -7.250 MTR	ROTARY
7	80	SCHEDULE-D	1.3	UKA	JNA	JNA10BN003	Jet Pump	2NPL	1	Kg	35	70	UKA, -7.250 MTR	ROTARY
8	81	SCHEDULE-D	1.3	UKA	JNA	JNA10BN004	Jet Pump	2NPL	1	Kg	35	70	UKA, -7.250 MTR	ROTARY
9	82	SCHEDULE-D	1.4	UKA	JMN	JMN10AP001	Spray Pump	2NPL	1	Kg	10920	21840	UKA, -7.250 MTR	ROTARY
10	83	SCHEDULE-D	1.4	UKA	JMN	JMN20AP001	Spray Pump	2NPL	1	Kg	10920	21840	UKA, -7.250 MTR	ROTARY
11	84	SCHEDULE-D	1.4	UKA	JMN	JMN30AP001	Spray Pump	2NPL	1	Kg	10920	21840	UKA, -7.250 MTR	ROTARY
12	85	SCHEDULE-D	1.4	UKA	JMN	JMN40AP001	Spray Pump	2NPL	1	Kg	10920	21840	UKA, -7.250 MTR	ROTARY
13	86	SCHEDULE-D	1.4	UKA	JND	JND10AP001	Hp Emergency Injection Pump	2NPL	1	Kg	7220	14440	UKA, -7.250 MTR	ROTARY
14	87	SCHEDULE-D	1.4	UKA	JND	JND20AP001	Hp Emergency Injection Pump	2NPL	1	Kg	7220	14440	UKA, -7.250 MTR	ROTARY
15	88	SCHEDULE-D	1.4	UKA	JND	JND30AP001	Hp Emergency Injection Pump	2NPL	1	Kg	7220	14440	UKA, -7.250 MTR	ROTARY
16	89	SCHEDULE-D	1.4	UKA	JND	JND40AP001	Hp Emergency Injection Pump	2NPL	1	Kg	7220	14440	UKA, -7.250 MTR	ROTARY
17	94	SCHEDULE-D	1.3	UKA	KTC	KTC21AP001	Pump Of Boran- Containing Water Collection Tank	2NPL	1	Kg	115	230	UKA, -7.250 MTR	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

18	95	SCHEDULE-D	1.3	UKA	KTC	KTC22AP001	Pump Of Boran- Containing Water Collection Tank	2NPL	1	Kg	115	230	UKA, -7.250 MTR	ROTARY
19	96	SCHEDULE-D	1.3	UKA	KTC	KTC23AP001	Pump Of Boran- Containing Water Collection Tank	2NPL	1	Kg	115	230	UKA, -7.250 MTR	ROTARY
20	97	SCHEDULE-D	1.3	UKA	KTC	KTC24AP001	Pump Of Boran- Containing Water Collection Tank	2NPL	1	Kg	115	230	UKA, -7.250 MTR	ROTARY
21	98	SCHEDULE-D	1.3	UKA	KTH	KTH16AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -7.250 MTR	ROTARY
22	99	SCHEDULE-D	1.3	UKA	KTH	KTH26AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -7.250 MTR	ROTARY
23	100	SCHEDULE-D	1.3	UKA	KTH	KTH36AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -7.250 MTR	ROTARY
24	101	SCHEDULE-D	1.3	UKA	KTH	KTH46AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -7.250 MTR	ROTARY
25	102	SCHEDULE-D	1.4	UKA	JND	JND50AP001	Emergency Boran Injection Pump	2NPL	1	Kg	5982	11964	UKA, -7.250 MTR	ROTARY
26	103	SCHEDULE-D	1.4	UKA	JND	JND60AP001	Emergency Boran Injection Pump	2NPL	1	Kg	5982	11964	UKA, -7.250 MTR	ROTARY
27	104	SCHEDULE-D	1.4	UKA	JND	JND70AP001	Emergency Boran Injection Pump	2NPL	1	Kg	5982	11964	UKA, -7.250 MTR	ROTARY
28	105	SCHEDULE-D	1.4	UKA	JND	JND80AP001	Emergency Boran Injection Pump	2NPL	1	Kg	5982	11964	UKA, -7.250 MTR	ROTARY
29	124	SCHEDULE-D	1.4	UKA	JNB	JNB10AP001	Sg Emergency Cooledown Pump	2NPL	1	Kg	1800	3600	UKA, -4.250 MTR	ROTARY
30	125	SCHEDULE-D	1.4	UKA	JNB	JNB20AP001	Sg Emergency Cooledown Pump	2NPL	1	Kg	1800	3600	UKA, -4.250 MTR	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
31	126	SCHEDULE-D	1.4	UKA	JNB	JNB30AP001	Sg Emergency Cooldown Pump	2NPL	1	Kg	1800	3600	UKA, -4.250 MTR	ROTARY
32	127	SCHEDULE-D	1.4	UKA	JNB	JNB40AP001	Sg Emergency Cooldown Pump	2NPL	1	Kg	1800	3600	UKA, -4.250 MTR	ROTARY
33	128	SCHEDULE-D	1.4	UKA	KAA	KAA10AP001	Closed Cooling Water System Pump	2NPL	1	Kg	12000	24000	UKA, -4.250 MTR	ROTARY
34	129	SCHEDULE-D	1.4	UKA	KAA	KAA20AP001	Closed Cooling Water System Pump	2NPL	1	Kg	12000	24000	UKA, -4.250 MTR	ROTARY
35	130	SCHEDULE-D	1.4	UKA	KAA	KAA30AP001	Closed Cooling Water System Pump	2NPL	1	Kg	12000	24000	UKA, -4.250 MTR	ROTARY
36	131	SCHEDULE-D	1.4	UKA	KAA	KAA40AP001	Closed Cooling Water System Pump	2NPL	1	Kg	12000	24000	UKA, -4.250 MTR	ROTARY
37	132	SCHEDULE-D	1.3	UKA	KTH	KTH15AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -4.250 MTR	ROTARY
38	133	SCHEDULE-D	1.3	UKA	KTH	KTH25AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -4.250 MTR	ROTARY
39	134	SCHEDULE-D	1.3	UKA	KTH	KTH35AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -4.250 MTR	ROTARY
40	135	SCHEDULE-D	1.3	UKA	KTH	KTH45AP001	Submersible Pumps	2NPL	1	Kg	220	440	UKA, -4.250 MTR	ROTARY
41	136	SCHEDULE-D	1.3	UKA	JNA	JNA80AP001	Sprinkler Solution Mixing Pump	2NPL	1	Kg	115	230	UKA, -4.250 MTR	ROTARY
42	253	SCHEDULE-D	1.1	UKB	KUJ	KUJ12AN001	Gas Blower	3N	1	Kg	175	350	UKB, 5.40mts+	ROTARY
43	254	SCHEDULE-D	1.1	UKB	KUJ	KUJ12AN002	Gas Blower	3N	1	Kg	175	350	UKB, 5.40mts+	ROTARY
44	255	SCHEDULE-D	1.1	UKB	KUJ	KUJ13AN001	Gas Blower	3N	1	Kg	175	350	UKB, 5.40mts+	ROTARY
45	256	SCHEDULE-D	1.1	UKB	KUJ	KUJ13AN002	Gas Blower	3N	1	Kg	175	350	UKB, 5.40mts+	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

46	278	SCHEDULE-D	1.1	UKS	KPH	0 KPH10AP001	Pump	4 III	1	Kg	48.7	48.7	0.300+	ROTARY
47	279	SCHEDULE-D	1.1	UKS	KPH	0 KPH10AP002	Pump	4 III	1	Kg	22.4	22.4	0.300+	ROTARY
48	280	SCHEDULE-D	1.1	UKS	KPH	0 KPH10AP003	Pump	4 III	1	Kg	22.4	22.4	0.300+	ROTARY
49	281	SCHEDULE-D	1.1	UKS	KPH	0 KPH20AP001	Centrifugal Pump	3N IIb	1	Kg	235	235	0.200+	ROTARY
50	282	SCHEDULE-D	1.1	UKS	KPH	0 KPH30AP001	Centrifugal Pump	3N IIb	1	Kg	290	290	0.200+	ROTARY
51	283	SCHEDULE-D	1.1	UKS	KPH	0KPH30AP002	Centrifugal Pump	3N IIb	1	Kg	290	290	0.200+	ROTARY
52	284	SCHEDULE-D	1.1	UKS	KPH	0KPH30AP003	Centrifugal Pump	3N IIb	1	Kg	290	290	0.200+	ROTARY
53	285	SCHEDULE-D	1.1	UKS	KPH	0 KPH30AP004	Centrifugal Pump	3N IIb	1	Kg	290	290	0.200+	ROTARY
54	286	SCHEDULE-D	1.1	UKS	KPH	0KPH30AP005	Centrifugal Pump	3N IIb	1	Kg	290	290	0.200+	ROTARY
55	287	SCHEDULE-D	1.1	UKS	KPH	0KPH60AP001	Pump	4 III	1	Kg	105	105	0.350+	ROTARY
56	288	SCHEDULE-D	1.1	UKS	KPH	0KPH50AN002	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY
57	289	SCHEDULE-D	1.1	UKS	KPH	0KPH40AN002	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY
58	290	SCHEDULE-D	1.1	UKS	KPH	0KPH40AN001	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY
59	291	SCHEDULE-D	1.1	UKS	KPH	0KPH50AN001	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY
60	292	SCHEDULE-D	1.1	UKS	KPH	0KPH40AN004	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
61	293	SCHEDULE-D	1.1	UKS	KPH	0KPH50AN003	Fan Bp 12-26-2,5 T3	4 III	1	Kg	92	92	13.2+	ROTARY
62	294	SCHEDULE-D	1.1	UKS	KPH	0KPH40AN003	Fan Ab-3,5.2.02 Np270	4 III	1	Kg	200	200	13.4+	ROTARY
63	295	SCHEDULE-D	1.1	UKS	KPH	0KPH60AM001	Mixer	3N IIb	1	Kg	1040	1040	1.9+	ROTARY
64	296	SCHEDULE-D	1.1	UKS	KPH	0 KPH60AF001	Ash Conveyor	3N IIb	1	Kg	480	480	1.9+	ROTARY
65	297	SCHEDULE-D	1.1	UKS	KPH	0KPH60AN001	Fan Bp 12-26-2,5 T3	4 III	1	Kg	56.5	56.5	13.2+	ROTARY
66	298	SCHEDULE-D	1.1	UKS	KPA	0 KPA60AP001	Pump Of Emergency Oil Drain From Hydraulic Unit	4 III	1	Kg	49	49	0.100+	ROTARY
67	299	SCHEDULE-D	1.1	UKS	KPA	0 KPA60AP002	Pump Of Emergency Oil Drain From Hydraulic Unit	4 III	1	Kg	49	49	0.100+	ROTARY
68	300	SCHEDULE-D	1.1	UKS	KPA	0 KPA60AP003	Pump	4 III	1	Kg	49	49	0.100+	ROTARY
69	301	SCHEDULE-D	1.1	UKS	KPA	0KPA60AP004	Pump	4 III	1	Kg	49	49	0.100+	ROTARY
70	302	SCHEDULE-D	1.1	UKS	KPF	0KPF71AP001	Centrifugal Pump With Electric Motor	4 III	1	Kg	115	115	0.255+	ROTARY
71	303	SCHEDULE-D	1.1	UKS	KPF	0KPF71AP002	Centrifugal Pump With Electric Motor	4 III	1	Kg	115	115	0.255+	ROTARY
72	304	SCHEDULE-D	1.1	UKS	KPF	0KPF70AP001	Drain Water Pump With Electric Motor	4 III	1	Kg	77	77	0.150+	ROTARY
73	305	SCHEDULE-D	1.1	UKS	KPF	0KPF70AP002	Drain Water Pump With Electric Motor	4 III	1	Kg	77	77	0.150+	ROTARY
74	306	SCHEDULE-D	1.1	UKS	KPP	0KPP10AP001	Hydraulic Plant	4 III	1	Kg	860	860	0.250+	ROTARY
75	541	SCHEDULE-D	1.3	UKC	FAL	FAL51AP001	Fuel pond filling pump	QA3	1	KG	1700	3400	UKC02R001	ROTARY
76	542	SCHEDULE-D	1.3	UKC	FAL	FAL52AP002	Fuel pond filling pump	QA3	1	KG	1700	3400	UKC02R001	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

77	543	SCHEDULE-D	1.3	UKC	KTA	KTA21AP001	Controlled leakage pump	QA3	1	KG	910	1820	UKC02R003	ROTARY
78	544	SCHEDULE-D	1.3	UKC	KTA	KTA22AP001	Controlled leakage pump	QA3	1	KG	960	1920	UKC02R004	ROTARY
79	545	SCHEDULE-D	1.3	UKC	KTA	KTA23AP001	Controlled leakage pump	QA3	1	KG	960	1920	UKC02R005	ROTARY
80	546	SCHEDULE-D	1.3	UKC	KTC	KTC10AP001	Pump of Borated water collecting tank	QA3	1	KG	115	230	UKC02R006	ROTARY
81	547	SCHEDULE-D	1.3	UKC	FAL	FAL71AP001	Pump of water supply from storage pool to purification.	QA3	1	KG	470	940	UKC02R007	ROTARY
82	548	SCHEDULE-D	1.3	UKC	FAL	FAL72AP001	Pump of water supply from storage pool to purification.	QA3	1	KG	470	940	UKC02R007	ROTARY
83	549	SCHEDULE-D	1.3	UKC	FAL	FAL73AP001	Pump of water supply from storage pool to purification.	QA3	1	KG	470	940	UKC02R007	ROTARY
84	550	SCHEDULE-D	1.3	UKC	KPF	KPF15AP001	Decantate pumps	QA3	1	KG	310	620	UKC02R019	ROTARY
85	551	SCHEDULE-D	1.3	UKC	KPF	KPF15AP002	Decantate pumps	QA3	1	KG	310	620	UKC02R016	ROTARY
86	552	SCHEDULE-D	1.3	UKC	KBC	KBC11AP001	Distillate pump	QA3	1	KG	460	920	UKC02R010	ROTARY
87	553	SCHEDULE-D	1.3	UKC	KBC	KBC12AP001	Distillate pump	QA3	1	KG	460	920	UKC02R010	ROTARY
88	554	SCHEDULE-D	1.3	UKC	KBC	KBC13AP001	Distillate pump	QA3	1	KG	460	920	UKC02R010	ROTARY
89	555	SCHEDULE-D	1.3	UKC	KTH	KTH50AP001	Active waste water disposal pump	QA3	1	KG	650	1300	UKC02R009	ROTARY
90	556	SCHEDULE-D	1.3	UKC	KTH	KTH50AP002	Active waste water disposal pump	QA3	1	KG	650	1300	UKC02R009	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
91	557	SCHEDULE-D	1.3	UKC	KTH	KTH50AP003	Vacuum Pump	QA3	1	KG	350	700	UKC02R009	ROTARY
92	558	SCHEDULE-D	1.3	UKC	LCL	LCL61AP001	pump of water drain from SG	QA3	1	KG	645	1290	UKC02R011	ROTARY
93	559	SCHEDULE-D	1.3	UKC	KBB	KBB20AP001	Boron containing water pump	QA3	1	KG	120	240	UKC06R068	ROTARY
94	560	SCHEDULE-D	1.3	UKC	KBB	KBB20AP002	Boron containing water pump	QA3	1	KG	120	240	UKC06R068	ROTARY
95	561	SCHEDULE-D	1.3	UKC	KBB	KBB20AP003	Boron containing water pump	QA3	1	KG	120	240	UKC06R063	ROTARY
96	562	SCHEDULE-D	1.3	UKC	KBB	KBB20AP004	Boron containing water pump	QA3	1	KG	120	240	UKC06R064	ROTARY
97	563	SCHEDULE-D	1.3	UKC	KPF	KPF60AP001	Auxiliary pump	QA3	1	KG	480	960	UKC06R051	ROTARY
98	564	SCHEDULE-D	1.3	UKC	KPF	KPF60AP002	Auxiliary pump	QA3	1	KG	480	960	UKC06R051	ROTARY
99	565	SCHEDULE-D	1.3	UKC	KPF	KPF60AP003	Auxiliary pump	QA3	1	KG	480	960	UKC06R051	ROTARY
100	566	SCHEDULE-D	1.3	UKC	FKT	FKT40AP001	Decontaminating solution supply pump	QA3	1	KG	300	600	UKC06R051	ROTARY
101	567	SCHEDULE-D	1.3	UKC	FKT	FKT40AP002	Decontaminating solution supply pump	QA3	1	KG	300	600	UKC06R051	ROTARY
102	568	SCHEDULE-D	1.3	UKC	FKT	FKT50AP001	Decontaminating solution supply pump	QA3	1	KG	300	600	UKC06R051	ROTARY
103	569	SCHEDULE-D	1.3	UKC	FKT	FKT50AP002	Decontaminating solution supply pump	QA3	1	KG	300	600	UKC06R051	ROTARY
104	570	SCHEDULE-D	1.3	UKC	KPJ	KPJ10AP001	Pump for boric acid complete set pump	QA3	1	KG	240	480	UKC06R051	ROTARY
105	571	SCHEDULE-D	1.3	UKC	KPJ	KPJ10AP002	Pump for boric acid complete set pump	QA3	1	KG	240	480	UKC06R051	ROTARY
106	572	SCHEDULE-D	1.3	UKC	KPJ	KPJ10AP003	Boric acid pump	QA3	1	KG	130	260	UKC06R051	ROTARY
107	573	SCHEDULE-D	1.3	UKC	KBB	KBB30AP001	Primary circuit filling pump	QA3	1	KG	320	640	UKC06R019	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

108	574	SCHEDULE-D	1.3	UKC	KBB	KBB40AP001	Vacuum Pump	QA3	1	KG	350	700	UKC06R020	ROTARY
109	575	SCHEDULE-D	1.3	UKC	KPF	KPF12AP001	Vacuum Pump	QA3	1	KG	350	700	UKC06R023	ROTARY
110	576	SCHEDULE-D	1.3	UKC	KPK	KPK20AP001	Vacuum Pump	QA3	1	KG	350	700	UKC06R042	ROTARY
111	577	SCHEDULE-D	1.3	UKC	KPK	KPK20AP002	Vacuum Pump	QA3	1	KG	350	700	UKC06R042	ROTARY
112	578	SCHEDULE-D	1.3	UKC	KBA	KBA31AP001	Make up pump	QA3	1	KG	8800	17600	UKC06R024	ROTARY
113	579	SCHEDULE-D	1.3	UKC	KBA	KBA32AP001	Make up pump	QA3	1	KG	8800	17600	UKC06R024	ROTARY
114	580	SCHEDULE-D	1.3	UKC	KBA	KBA33AP001	Make up pump	QA3	1	KG	8800	17600	UKC06R024	ROTARY
115	581	SCHEDULE-D	1.3	UKC	KBF	KBF50AP001	Boric concentrate pump	QA3	1	KG	298	596	UKC06R054	ROTARY
116	582	SCHEDULE-D	1.3	UKC	KBF	KBF50AP002	Boric concentrate pump	QA3	1	KG	298	596	UKC06R054	ROTARY
117	583	SCHEDULE-D	1.3	UKC	LFG	LFG50AP001	Flushing solution complete set pump	QA3	1	KG	1060	2120	UKC06R025	ROTARY
118	584	SCHEDULE-D	1.3	UKC	LFG	LFG50AP002	Flushing solution complete set pump	QA3	1	KG	1060	2120	UKC06R025	ROTARY
119	585	SCHEDULE-D	1.3	UKC	KBC	KBC60AP001	Boron concentrate pump	QA3	1	KG	298	596	UKC06R016	ROTARY
120	586	SCHEDULE-D	1.3	UKC	KBC	KBC50AP001	Boron concentrate pump	QA3	1	KG	290	580	UKC06R016	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
121	587	SCHEDULE-D	1.3	UKC	KBC	KBC50AP002	Boron concentrate pump	QA3	1	KG	290	580	UKC06R016	ROTARY
122	588	SCHEDULE-D	1.3	UKC	KBC	KBC50AP003	Boron concentrate pump	QA3	1	KG	290	580	UKC06R016	ROTARY
123	589	SCHEDULE-D	1.3	UKC	KPF	KPF13AP001	Floor drain pump	QA3	1	KG	120	240	UKC06R057	ROTARY
124	590	SCHEDULE-D	1.3	UKC	KPF	KPF13AP002	Floor drain pump	QA3	1	KG	120	240	UKC06R057	ROTARY
125	591	SCHEDULE-D	1.3	UKC	KBC	KBC21AP001	Deistillate pump	QA3	1	KG	460	920	UKC06R015	ROTARY
126	592	SCHEDULE-D	1.3	UKC	KBC	KBC22AP001	Deistillate pump	QA3	1	KG	460	920	UKC06R015	ROTARY
127	593	SCHEDULE-D	1.3	UKC	KPK	KPK40AP001	Sorbent pumps	QA3	1	KG	575	1150	UKC06R049	ROTARY
128	594	SCHEDULE-D	1.3	UKC	LCM	LCM81AP001	Condensate pump	QA3	1	KG	550	1100	UKC06R056	ROTARY
129	595	SCHEDULE-D	1.3	UKC	LCM	LCM81AP002	Condensate pump	QA3	1	KG	550	1100	UKC06R056	ROTARY
130	596	SCHEDULE-D	1.3	UKC	KWB	KWB50AP001	SG hydrotest pumps	QA3	1	KG	750	1500	UKC06R010	ROTARY
131	597	SCHEDULE-D	1.3	UKC	KBF	KBF30AP001	Degassed water pump	QA3	1	KG	115	230	UKC10R026	ROTARY
132	598	SCHEDULE-D	1.3	UKC	KBF	KBF30AP002	Degassed water pump	QA3	1	KG	115	230	UKC10R026	ROTARY
133	599	SCHEDULE-D	1.3	UKC	KPF	KPF30AP001	Deaerated water pump	QA3	1	KG	115	230	UKC10R027	ROTARY
134	600	SCHEDULE-D	1.3	UKC	KPF	KPF30AP002	Deaerated water pump	QA3	1	KG	115	230	UKC10R027	ROTARY
135	601	SCHEDULE-D	1.3	UKC	KBF	KBF40AP001	Control tanks pump	QA3	1	KG	240	480	UKC10R033	ROTARY
136	602	SCHEDULE-D	1.3	UKC	KBF	KBF40AP002	Control tanks pump	QA3	1	KG	240	480	UKC10R033	ROTARY
137	603	SCHEDULE-D	1.3	UKC	KWA	KWA10AP001	Pump of relief tank hydraulic test&distillate blowdown of I&C	QA3	1	KG	250	500	UKC10R008	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

							sensors							
138	604	SCHEDULE-D	1.3	UKC	KPF	KPF40AP001	Control tanks pump	QA3	1	KG	240	480	UKC10R033	ROTARY
139	605	SCHEDULE-D	1.3	UKC	KPF	KPF40AP002	Control tanks pump	QA3	1	KG	240	480	UKC10R033	ROTARY
140	606	SCHEDULE-D	1.3	UKC	KWC	KWC20AP001	Hydraulic test pumps of Primary circuits	QA3	1	KG	2530	5060	UKC13R002	ROTARY
141	607	SCHEDULE-D	1.3	UKC	KWC	KWC10AP001	Hydraulic test pumps of ECCS tanks	QA3	1	KG	2530	5060	UKC13R002	ROTARY
142	608	SCHEDULE-D	1.3	UKC	KPF	KPF50AP001	Low salt drains pump	QA3	1	KG	480	960	UKC13R022	ROTARY
143	609	SCHEDULE-D	1.3	UKC	KPF	KPF50AP002	Low salt drains pump	QA3	1	KG	480	960	UKC13R022	ROTARY
144	610	SCHEDULE-D	1.3	UKC	KPJ	KPJ20AP001	Caustic potash supply tank pump	QA3	1	KG	140	280	UKC13R019	ROTARY
145	611	SCHEDULE-D	1.3	UKC	KPJ	KPJ60AP001	Ammonia dosing pump	QA3	1	KG	150	300	UKC17R020	ROTARY
146	612	SCHEDULE-D	1.3	UKC	KPJ	KPJ60AP002	Ammonia dosing pump	QA3	1	KG	150	300	UKC17R020	ROTARY
147	613	SCHEDULE-D	1.3	UKC	KPJ	KPJ50AP001	Hydrazine solution dosing pumps	QA3	1	KG	150	300	UKC17R014	ROTARY
148	614	SCHEDULE-D	1.3	UKC	KPJ	KPJ50AP002	Hydrazine solution dosing pumps	QA3	1	KG	150	300	UKC17R014	ROTARY
149	615	SCHEDULE-D	1.3	UKC	KPJ	KPJ40AP003	Caustic soda solution dosing pump	QA3	1	KG	130	260	UKC17R019	ROTARY
150	616	SCHEDULE-D	1.3	UKC	KPJ	KPJ40AP004	Caustic soda solution dosing pump	QA3	1	KG	130	260	UKC17R019	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF ROTARY EQUIPMENT														
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2. (2) The quantities of KKNPP Unit-3&4 is subject to change.														
SL.NO	Cust ref no	SCHEDULE	BOQ ITEM NO	BUILDING	SYSTEM KKS CODE	CODE AS PER KKS	NAME OF THE EQUIPMENTS	QA CATEGORY	QUANTITY UNIT-3 & COMMON	UOM	MASS (Per Unit)	MASS (For Both Units)	LOCATION (ELEVATION)	TYPE OF EQUIPMENT
151	617	SCHEDULE-D	1.3	UKC	KPJ	KPJ40AP001	Alkaline solution dosing pump	QA3	1	KG	130	260	UKC17R016	ROTARY
152	618	SCHEDULE-D	1.3	UKC	KPJ	KPJ40AP002	Alkaline solution dosing pump	QA3	1	KG	130	260	UKC17R016	ROTARY
153	619	SCHEDULE-D	1.3	UKC	KPJ	KPJ20AP002	Potassium hydroxide solution dosing pump	QA3	1	KG	130	260	UKC17R019	ROTARY
154	620	SCHEDULE-D	1.3	UKC	KPJ	KPJ20AP003	Potassium hydroxide solution dosing pump	QA3	1	KG	130	260	UKC17R019	ROTARY
155	621	SCHEDULE-D	1.3	UKC	KPJ	KPJ30AP001	Nitric acid solution dosing pump	QA3	1	KG	130	260	UKC17R015	ROTARY
156	622	SCHEDULE-D	1.3	UKC	KPJ	KPJ30AP002	Nitric acid solution dosing pump	QA3	1	KG	130	260	UKC17R015	ROTARY
157	623	SCHEDULE-D	1.3	UKC	KBD	KBD10AP001	Potassium hydroxide dosing pump	QA3	1	KG	47	94	UKC17R019	ROTARY
158	624	SCHEDULE-D	1.3	UKC	KBD	KBD20AP001	Hydrazine dosing pump	QA3	1	KG	47	94	UKC17R014	ROTARY
159	625	SCHEDULE-D	1.3	UKC	KBD	KBD30AP001	Ammonia dosing pump	QA3	1	KG	47	94	UKC17R020	ROTARY
160	626	SCHEDULE-D	1.3	UKC	KBD	KBD30AP002	Ammonia dosing pump	QA3	1	KG	47	94	UKC17R020	ROTARY
161	627	SCHEDULE-D	1.3	UKC	KBC	KBC30AP001	Pump of distillate supply to end seals of RCP	QA3	1	KG	115	230	UKC17R001	ROTARY
162	628	SCHEDULE-D	1.3	UKC	KPL	KPL11AN001	Gas blowers	QA3	1	KG	255	510	UKC20R012	ROTARY
163	629	SCHEDULE-D	1.3	UKC	KPL	KPL12AN001	Gas blowers	QA3	1	KG	255	510	UKC20R012	ROTARY
164	630	SCHEDULE-D	1.3	UKC	KPL	KPL13AN001	Gas blowers	QA3	1	KG	255	510	UKC20R012	ROTARY
165	631	SCHEDULE-D	1.3	UKC	KUJ	KUJ15AN001	Gas blowers	QA3	1	KG	130	260	UKC24R022	ROTARY
166	632	SCHEDULE-D	1.3	UKC	KUJ	KUJ15AN002	Gas blowers	QA3	1	KG	130	260	UKC24R022	ROTARY
167	633	SCHEDULE-D	1.3	UKC	KUJ	KUJ15AN003	Gas blowers	QA3	1	KG	130	260	UKC24R022	ROTARY

TECHNICAL CONDITIONS OF CONTRACT (TCC)

168	634	SCHEDULE-D	1.3	UKC	KPM	KPM41AN001	GAS BLOWER	QA3	1	KG	280	560	UKC24R022	ROTARY
169	635	SCHEDULE-D	1.3	UKC	KPM	KPM42AN001	GAS BLOWER	QA3	1	KG	280	560	UKC24R022	ROTARY
170	636	SCHEDULE-D	1.3	UKC	KUJ	KUJ11AN001	Gas blowers	QA3	1	KG	130	260	UKC34R004	ROTARY
171	637	SCHEDULE-D	1.3	UKC	KUJ	KUJ11AN002	Gas blowers	QA3	1	KG	130	260	UKC34R004	ROTARY
172	638	SCHEDULE-D	1.3	UKC	KUJ	KUJ14AN001	Gas blowers	QA3	1	KG	130	260	UKC34R004	ROTARY
173	639	SCHEDULE-D	1.3	UKC	KUJ	KUJ14AN002	Gas blowers	QA3	1	KG	130	260	UKC34R004	ROTARY
174	640	SCHEDULE-D	1.3	UKC	KUJ	KUJ14AN003	Gas blowers	QA3	1	KG	130	260	UKC34R004	ROTARY
175	641	SCHEDULE-D	1.3	UKC	KUJ	KUJ17AN001	Gas blowers	QA3	1	KG	130	260	UKC34R006	ROTARY
176	642	SCHEDULE-D	1.3	UKC	KUJ	KUJ16AN001	Gas blowers	QA3	1	KG	130	260	UKC34R008	ROTARY
TOTAL WEIGHT (in KG)											26874 2	53129 2		
TOTAL WEIGHT (in MT)											269	531		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF SS PIPING SYSTEMS WITH WEIGHT AND WELDING SCOPE																
S.no	Cust Ref no	BUILDING	SCHEDULE	ITEM NO	SYSTEM	WD NO	Material of construction	UOM	Weight of Piping		Weight of pipe supports		Small bore Inch Dia		Big Bore Inch dia	
									Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4
1	68	UJY	SCHEDULE-D	2	FKT	R01.KK.0 UJY.FKT.TM.OK.WD002	SS/C S	MT	4.275	4.275	1.380	1.380	153.000	153.000	404.000	404.000
2	69	UJY	SCHEDULE-D	2	FKT	R01.KK.0 UJY.FKT.TM.OK.WD001	SS	MT	3.435	3.435	5.481	5.481	600.000	600.000	0.000	0.000
3	70	UJY	SCHEDULE-D	2	KPK	R01.KK.0 UJY.KPK.TM.OK.WD001	SS	MT	1.430	1.430	0.532	0.532	281.000	281.000	0.000	0.000
4	72	UJY	SCHEDULE-D	2	LCM	R01.KK.0 UJY.LCM.10.TM.OK.WD002	SS	MT	0.000	0.000	0.000	0.000	240.000	240.000	0.000	0.000
5	74	UJY	SCHEDULE-D	2	LDP	R01.KK.0 UJY.LDP.TM.OK.WD001	SS	MT	0.833	0.833	0.102	0.102	42.000	42.000	0.000	0.000
6	75	UJY	SCHEDULE-D	2	LDR	R01.KK.0 UJY.LDR.TM.OK.WD001	SS	MT	0.753	0.753	0.206	0.206	0.000	0.000	64.000	64.000
7	77	UKA	SCHEDULE-D	2	FAL	R01.KK.1 UJA.FAL.TM.OK.WD001	SS	MT	3.193	3.193	2.692	2.692	95.000	95.000	727.000	727.000
8	78	UKA	SCHEDULE-D	2	FKA	R01.KK.2 UJA.FKA.TM.OK.WD001	SS	MT	0.770	0.770	0.682	0.682	227.000	227.000	0.000	0.000
9	81	UKA	SCHEDULE-D	2	JMN	RO1.KK.1 UJA.JMN.TM.OK.WD002	SS	MT	5.779	5.779	0.483	0.483	12.000	12.000	912.000	912.000
10	82	UKA	SCHEDULE-D	2	JMN	RO1.KK.1 UJA.JMN.TM.OK.WD003	SS	MT	12.150	12.150	3.174	3.174	170.000	170.000	1872.000	1872.000
11	83	UKA	SCHEDULE-D	2	JMN10	RO1.KK.2 UJA.JMN10.TM.OK.WD001	SS	MT	0.597	0.597	1.024	1.024	437.000	437.000	0.000	0.000
12	84	UKA	SCHEDULE-D	2	JNA	R01.KK.1 UJA.JNA.TM.OK.WD001	SS	MT	10.702	10.702	1.556	1.556	83.000	83.000	832.000	832.000
13	85	UKA	SCHEDULE-D	2	JNA	R01.KK.1 UJA.JNA.TM.OK.WD002	SS	MT	50.080	50.080	15.337	15.337	50.000	50.000	4618.000	4618.000
14	86	UKA	SCHEDULE-D	2	JNA	R01.KK.1 UJA.JNA.TM.OK.WD003	SS	MT	0.369	0.369	0.295	0.295	220.000	220.000	0.000	0.000
15	87	UKA	SCHEDULE-D	2	JNA10	R01.KK.1 UJA.JNA10.TM.OK.WD001	SS	MT	0.230	0.230	0.485	0.485	298.000	298.000	0.000	0.000
16	88	UKA	SCHEDULE-D	2	JNA80	R01.KK.1 UJA.JNA80.TM.OK.WD001	SS	MT	1.203	1.203	2.954	2.954	903.000	903.000	0.000	0.000
17	89	UKA	SCHEDULE-D	2	JNB	R01.KK.1 UJA.JNB.TM.OK.WD001	SS	MT	0.188	0.188	0.431	0.431	150.000	150.000	0.000	0.000
18	90	UKA	SCHEDULE-D	2	JNB	R01.KK.1 UJA.JNB.TM.OK.WD002	SS	MT	0.289	0.289	0.542	0.542	320.000	320.000	0.000	0.000
19	91	UKA	SCHEDULE-D	2	JNB	R01.KK.1 UJA.JNB.TM.OK.WD003	SS	MT	0.173	0.173	0.643	0.643	195.000	195.000	0.000	0.000

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20	92	UKA	SCHEDULE-D	2	JNB10	R01.KK.1 UJA.JNB10.TM.OK.WD001	SS	MT	16.540	16.540	5.068	5.068	605.000	605.000	1842.000	1842.000
21	93	UKA	SCHEDULE-D	2	JND10	R01.KK.1 UJA.JND10.TM.OK.WD001	SS	MT	4.478	4.478	1.482	1.482	80.000	80.000	550.000	550.000
22	94	UKA	SCHEDULE-D	2	JND10	R01.KK.1 UJA.JND10.TM.OK.WD002	SS	MT	1.696	1.696	0.247	0.247	80.000	80.000	358.000	358.000
23	95	UKA	SCHEDULE-D	2	JND10	R01.KK.1 UJA.JND10.TM.OK.WD004	SS	MT	0.476	0.476	1.139	1.139	460.000	460.000	0.000	0.000
24	96	UKA	SCHEDULE-D	2	JND50	R01.KK.1 UJA.JND50.TM.OK.WD001	SS	MT	1.234	1.234	0.586	0.586	150.000	150.000	406.000	406.000
25	97	UKA	SCHEDULE-D	2	JND50	R01.KK.1 UJA.JND50.TM.OK.WD002	SS	MT	1.284	1.284	1.071	1.071	270.000	270.000	0.000	0.000
26	98	UKA	SCHEDULE-D	2	JND50	R01.KK.1 UJA.JND50.TM.OK.WD004	SS	MT	0.642	0.642	0.888	0.888	500.000	500.000	0.000	0.000
27	99	UKA	SCHEDULE-D	2	KAA	R01.KK.1 UJA.KAA.TM.OK.WD001	SS	MT	116.080	116.080	47.401	47.401	1165.000	1165.000	18724.000	18724.000
28	100	UKA	SCHEDULE-D	2	KAA	R01.KK.1 UJA.KAA.TM.OK.WD003	SS	MT	3.120	3.120	4.474	4.474	1760.000	1760.000	690.000	690.000
29	101	UKA	SCHEDULE-D	2	KAA10	R01.KK.1 UJA.KAA10.TM.OK.WD001	SS	MT	0.315	0.315	0.817	0.817	278.000	278.000	0.000	0.000
30	102	UKA	SCHEDULE-D	2	KAA90	R01.KK.2 UJA.KAA90.TM.OK.WD001	SS	MT	0.377	0.377	0.821	0.821	560.000	560.000	0.000	0.000
31	103	UKA	SCHEDULE-D	2	KBC10	R01.KK.1 UJA.KBC10.TM.OK.WD001	SS	MT	0.909	0.909	0.244	0.244	60.000	60.000	80.000	80.000
32	104	UKA	SCHEDULE-D	2	KPM	R01.KK.2 UJA.KPM.TM.OK.WD001	SS	MT	6.944	6.944	7.933	7.933	2865.000	2865.000	0.000	0.000
33	105	UKA	SCHEDULE-D	2	KPM	R01.KK.2 UJA.KPM.TM.OK.WD002	SS	MT	0.264	0.264	0.910	0.910	511.000	511.000	0.000	0.000
34	106	UKA	SCHEDULE-D	2	KTC10	R01.KK.2 UJA.KTC10.TM.OK.WD001	SS	MT	0.605	0.605	0.462	0.462	420.000	420.000	0.000	0.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF SS PIPING SYSTEMS WITH WEIGHT AND WELDING SCOPE																
S.no	Cust Ref no	BUILDING	SCHEDULE	ITEM NO	SYSTEM	WD NO	Material of construction	UOM	Weight of Piping		Weight of pipe supports		Small bore Inch Dia		Big Bore Inch dia	
									Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4
35	107	UKA	SCHEDULE-D	2	KTC10	R01.KK.2 UJA.KTC10.TM.OK.WD004	SS	MT	1.054	1.054	1.337	1.337	656.000	656.000	0.000	0.000
36	108	UKA	SCHEDULE-D	2	KTF	R01.KK.1 UJA.KTF.TM.OK.WD001	SS	MT	1.400	1.400	2.466	2.466	1350.000	1350.000	0.000	0.000
37	109	UKA	SCHEDULE-D	2	KTF	R01.KK.1 UJA.KTF.TM.OK.WD002	SS	MT	0.152	0.152	0.237	0.237	250.000	250.000	18.000	18.000
38	110	UKA	SCHEDULE-D	2	KTH	R01.KK.1 UJA.KTH.TM.OK.WD001	SS	MT	0.703	0.703	0.848	0.848	400.000	400.000	0.000	0.000
39	111	UKA	SCHEDULE-D	2	KUA10	R01.KK.2 UJA.KUA10.TM.OK.WD001	SS	MT	0.573	0.573	1.408	1.408	423.000	423.000	0.000	0.000
40	112	UKA	SCHEDULE-D	2	KUJ11	R01.KK.2 UJA.KUJ11.TM.OK.WD001	SS	MT	0.277	0.277	1.379	1.379	302.000	302.000	0.000	0.000
41	113	UKA	SCHEDULE-D	2	KWA	R01.KK.2 UJA.KWA.TM.OK.WD001	SS	MT	0.033	0.033	0.129	0.129	63.000	63.000	0.000	0.000
42	114	UKA	SCHEDULE-D	2	KWB	R01.KK.2 UJA.KWB.TM.OK.WD001	SS	MT	0.846	0.846	0.396	0.396	180.000	180.000	0.000	0.000
43	115	UKA	SCHEDULE-D	2	KWC	R01.KK.2 UJA.KWC.TM.OK.WD001	SS	MT	0.511	0.511	0.458	0.458	350.000	350.000	0.000	0.000
44	116	UKA	SCHEDULE-D	2	KWC	R01.KK.2 UJA.KWC.TM.OK.WD002	SS	MT	0.347	0.347	0.258	0.258	438.000	438.000	0.000	0.000
45	117	UKA	SCHEDULE-D	2	LCQ50	R01.KK.2 UJA.LCQ50.TM.OK.WD001	SS	MT	18.141	18.141	7.014	7.014	970.000	970.000	0.000	0.000
46	118	UKA	SCHEDULE-D	2	LCQ50	R01.KK.2 UJA.LCQ50.TM.OK.WD002	SS	MT	0.496	0.496	0.589	0.589	406.000	406.000	0.000	0.000
47	120	UKA	SCHEDULE-D	2	QFA	R01.KK.2 UJA.QFA.TM.OK.WD001	SS	MT	0.906	0.906	1.561	1.561	551.000	551.000	0.000	0.000
48	122	UKA	SCHEDULE-D	2	QUH	R01.KK.2 UJA.QUH.TM.OK.WD001	SS	MT	0.194	0.194	0.679	0.679	260.000	260.000	0.000	0.000
49	123	UKA	SCHEDULE-D	2	QUK	R01.KK.2 UJA.QUK.TM.OK.WD001	SS	MT	0.164	0.164	1.016	1.016	450.000	450.000	0.000	0.000
50	125	UKC	SCHEDULE-D	2	FAL	R01.KK.1UKC.FAL.TM.OK.WD001	SS	MT	18.983	18.983	4.360	4.360	537.500	537.500	1928.000	1928.000
51	126	UKC	SCHEDULE-D	2	FBA	R01.KK.1UKC.FBA.TM.OK.WD001	SS	MT	0.845	0.845	0.286	0.286	953.500	953.500	0.000	0.000
52	127	UKC	SCHEDULE-D	2	FBA50	R01.KK.1UKC.FBA.TM.OK.WD001	SS	MT	0.783	0.783	0.223	0.223	324.000	324.000	0.000	0.000
53	128	UKC	SCHEDULE-D	2	FKA	R01.KK.1UKC.FKA.TM.OK.WD001	SS	MT	13.728	13.728	7.923	7.923	5427.800	5427.800	0.000	0.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

54	129	UKC	SCHEDULE-D	2	FKT	R01.KK.1UKC.FKT.TM.OK.WD001	SS/C S	MT	6.759	6.759	2.236	2.236	2781.500	2781.500	528.000	528.000
55	132	UKC	SCHEDULE-D	2	JEA50	R01.KK.1UKC.JEA50.TM.OK.WD001	SS	MT	0.924	0.924	2.102	2.102	699.500	699.500	0.000	0.000
56	133	UKC	SCHEDULE-D	2	JEV 50	R01.KK.1UKC.JEV50.TM.OK.WD001	SS	MT	0.157	0.157	0.079	0.079	67.500	67.500	0.000	0.000
57	134	UKC	SCHEDULE-D	2	JMY20	R01.KK.1UKC.JMY20.TM.OK.WD001	SS	MT	0.155	0.155	0.274	0.274	82.500	82.500	0.000	0.000
58	135	UKC	SCHEDULE-D	2	KAA	R01.KK.1UKC.KAA.TM.OK.WD001	SS	MT	8.885	8.885	5.267	5.267	4166.000	4166.000	832.000	832.000
59	136	UKC	SCHEDULE-D	2	KAA	R01.KK.1UKC.KAA.TM.OK.WD002	SS	MT	0.498	0.498	0.730	0.730	486.000	486.000	0.000	0.000
60	137	UKC	SCHEDULE-D	2	KBA	R01.KK.1UKC.KBA.TM.OK.WD001	SS	MT	9.553	9.553	4.011	4.011	901.000	901.000	1620.000	1620.000
61	138	UKC	SCHEDULE-D	2	KBA	R01.KK.1UKC.KBA.TM.OK.WD002	SS	MT	5.787	5.787	0.970	0.970	123.000	123.000	554.000	554.000
62	139	UKC	SCHEDULE-D	2	KBA	R01.KK.1UKC.KBA.TM.OK.WD003	SS	MT	0.491	0.491	0.586	0.586	460.750	460.750	0.000	0.000
63	140	UKC	SCHEDULE-D	2	KBB	R01.KK.1UKC.KBB.TM.OK.WD001	SS	MT	9.183	9.183	5.809	5.809	3038.750	3038.750	1092.000	1092.000
64	141	UKC	SCHEDULE-D	2	KBC10	R01.KK.1UKC.KBC10.TM.OK.WD001	SS	MT	12.976	12.976	6.329	6.329	1221.500	1221.500	2240.000	2240.000
65	142	UKC	SCHEDULE-D	2	KBC40	R01.KK.1UKC.KBC40.TM.OK.WD001	SS	MT	3.434	3.434	2.009	2.009	902.800	902.800	628.000	628.000
66	143	UKC	SCHEDULE-D	2	KBD	R01.KK.1UKC.KBD.TM.OK.WD001	SS	MT	0.908	0.908	0.340	0.340	430.800	430.800	0.000	0.000
67	144	UKC	SCHEDULE-D	2	KBE 50-60	R01.KK.1UKC.KBE.TM.OK.WD001	SS	MT	4.878	4.878	2.374	2.374	2888.000	2888.000	326.000	326.000
68	145	UKC	SCHEDULE-D	2	KBE 50-60	R01.KK.1UKC.KBE.TM.OK.WD002	SS	MT	2.626	2.626	1.458	1.458	1948.000	1948.000	0.000	0.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF SS PIPING SYSTEMS WITH WEIGHT AND WELDING SCOPE

S.no	Cust Ref no	BUILDING	SCHEDULE	ITEM NO	SYSTEM	WD NO	Material of construction	UOM	Weight of Piping		Weight of pipe supports		Small bore Inch Dia		Big Bore Inch dia	
									Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4
69	146	UKC	SCHEDULE-D	2	KBE10	R01.KK.1UKC.KBE10.TM.OK.WD001	SS	MT	0.709	0.709	0.206	0.206	447.000	447.000	0.000	0.000
70	147	UKC	SCHEDULE-D	2	KBF	R01.KK.1UKC.KBF.TM.OK.WD001	SS	MT	5.949	5.949	2.851	2.851	2314.500	2314.500	716.000	716.000
71	148	UKC	SCHEDULE-D	2	KBF	R01.KK.1UKC.KBF.TM.OK.WD002	SS	MT	5.152	5.152	2.882	2.882	4214.000	4214.000	4.000	4.000
72	149	UKC	SCHEDULE-D	2	KBH	R01.KK.1UKC.KBH.TM.OK.WD001,	SS	MT	1.065	1.065	0.738	0.738	773.000	773.000	92.000	92.000
73	150	UKC	SCHEDULE-D	2	KBH	R01.KK.1UKC.KBH.TM.OK.WD002	SS	MT	1.645	1.645	1.377	1.377	1387.000	1387.000	20.000	20.000
74	151	UKC	SCHEDULE-D	2	KPC	R01.KK.1UKC.KPC.TM.OK.WD001	SS	MT	0.206	0.206	0.290	0.290	129.500	129.500	0.000	0.000
75	152	UKC	SCHEDULE-D	2	KPC	R01.KK.1UKC.KPC.TM.OK.WD002	SS	MT	0.594	0.594	0.656	0.656	336.000	336.000	20.000	20.000
76	153	UKC	SCHEDULE-D	2	KPF	R01.KK.1UKC.KPF.TM.OK.WD001	SS	MT	10.998	10.998	5.482	5.482	7569.000	7569.000	488.000	488.000
77	154	UKC	SCHEDULE-D	2	KPF	R01.KK.1UKC.KPF.TM.OK.WD002	SS	MT	5.547	5.547	1.813	1.813	2063.300	2063.300	886.000	886.000
78	155	UKC	SCHEDULE-D	2	KPF	R01.KK.1UKC.KPF.TM.OK.WD003	SS	MT	11.407	11.407	9.152	9.152	5485.300	5485.300	1516.000	1516.000
79	156	UKC	SCHEDULE-D	2	KPJ	R01.KK.1UKC.KPJ.TM.OK.WD001	SS	MT	7.842	7.842	4.526	4.526	5450.300	5450.300	0.000	0.000
80	157	UKC	SCHEDULE-D	2	KPK	R01.KK.1UKC.KPK.TM.OK.WD001	SS	MT	8.972	8.972	3.091	3.091	5662.000	5662.000	172.000	172.000
81	158	UKC	SCHEDULE-D	2	KPL	R01.KK.1UKC.KPL.TM.OK.WD001	SS	MT	4.903	4.903	2.991	2.991	2959.500	2959.500	64.000	64.000
82	159	UKC	SCHEDULE-D	2	KPM40	R01.KK.1UKC.KPM 40.TM.OK.WD001	SS	MT	4.168	4.168	2.412	2.412	2120.800	2120.800	24.000	24.000
83	160	UKC	SCHEDULE-D	2	KPN	R01.KK.1UKC.KPN.TM.OK.WD001	SS	MT	0.800	0.800	0.626	0.626	885.300	885.300	16.000	16.000
84	161	UKC	SCHEDULE-D	2	KPN	R01.KK.1UKC.KPN.TM.OK.WD002	SS	MT	1.376	1.376	0.819	0.819	1215.800	1215.800	12.000	12.000
85	162	UKC	SCHEDULE-D	2	KRA	R01.KK.1UKC.KRA.TM.OK.WD001	SS	MT	1.050	1.050	0.630	0.630	890.000	890.000	0.000	0.000
86	163	UKC	SCHEDULE-D	2	KRQ	R01.KK.1UKC.KRQ.TM.OK.WD001	SS	MT	0.080	0.080	0.088	0.088	2.000	2.000	0.000	0.000
87	164	UKC	SCHEDULE-D	2	KTA	R01.KK.1UKC.KTA.TM.OK.WD001	SS	MT	2.094	2.094	1.506	1.506	504.300	504.300	156.000	156.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

88	165	UKC	SCHEDULE-D	2	KTB	R01.KK.1UKC.KTB.TM.OK.WD001	SS	MT	0.912	0.912	0.582	0.582	514.000	514.000	0.000	0.000
89	166	UKC	SCHEDULE-D	2	KTC	R01.KK.1UKC.KTC10.TM.OK.WD001	SS	MT	2.028	2.028	1.002	1.002	817.500	817.500	0.000	0.000
90	167	UKC	SCHEDULE-D	2	KTH	R01.KK.1UKC.KTH.TM.OK.WD001	SS	MT	3.028	3.028	0.953	0.953	690.800	690.800	424.000	424.000
91	168	UKC	SCHEDULE-D	2	KTN	R01.KK.1UKC.KTN.TM.OK.WD001	SS	MT	13.992	13.992	0.369	0.369	0.000	0.000	0.000	0.000
92	169	UKC	SCHEDULE-D	2	KTN	R01.KK.1UKC.KTN.TM.OK.WD002	SS	MT	8.829	8.829	1.547	1.547	4336.000	4336.000	584.000	584.000
93	170	UKC	SCHEDULE-D	2	KUA10	R01.KK.1UKC.KUA10.TM.OK.WD001	SS	MT	0.928	0.928	1.768	1.768	111.000	111.000	0.000	0.000
94	171	UKC	SCHEDULE-D	2	KUA60	R01.KK.1UKC.KUA60.TM.OK.WD001	SS	MT	0.186	0.186	0.600	0.600	115.000	115.000	0.000	0.000
95	172	UKC	SCHEDULE-D	2	KUE	R01.KK.1UKC.KUE.TM.OK.WD001	SS	MT	0.307	0.307	0.894	0.894	60.000	60.000	0.000	0.000
96	173	UKC	SCHEDULE-D	2	KUE	R01.KK.1UKC.KUE.TM.OK.WD002	SS	MT	0.538	0.538	1.103	1.103	252.000	252.000	0.000	0.000
97	174	UKC	SCHEDULE-D	2	KUJ 11	R01.KK.1UKC.KUJ11.TM.OK.WD001	SS	MT	0.318	0.318	0.541	0.541	300.000	300.000	0.000	0.000
98	175	UKC	SCHEDULE-D	2	KUJ16	R01.KK.1UKC.KUJ16.TM.OK.WD001	SS	MT	0.255	0.255	0.367	0.367	201.000	201.000	0.000	0.000
99	176	UKC	SCHEDULE-D	2	KWA	R01.KK.1UKC.KWA.TM.OK.WD001	SS	MT	0.694	0.694	0.422	0.422	407.500	407.500	0.000	0.000
100	177	UKC	SCHEDULE-D	2	KWB50	R01.KK.1UKC.KWB50.TM.OK.WD001	SS	MT	0.136	0.136	0.151	0.151	170.000	170.000	0.000	0.000
101	178	UKC	SCHEDULE-D	2	KWB60	R01.KK.1UKC.KWB60.TM.OK.WD001	SS	MT	0.037	0.037	0.051	0.051	27.500	27.500	0.000	0.000
102	179	UKC	SCHEDULE-D	2	KWC	R01.KK.1UKC.KWC.TM.OK.WD001	SS	MT	2.178	2.178	2.691	2.691	1152.500	1152.500	0.000	0.000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF SS PIPING SYSTEMS WITH WEIGHT AND WELDING SCOPE																
S.no	Cust Ref no	BUILDING	SCHEDULE	ITEM NO	SYSTEM	WD NO	Material of construction	UOM	Weight of Piping		Weight of pipe supports		Small bore Inch Dia		Big Bore Inch dia	
									Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4
103	180	UKC	SCHEDULE-D	2	KWC	R01.KK.1UKC.KWC.TM.OK.WD002	SS	MT	0.096	0.096	0.163	0.163				
104	182	UKC	SCHEDULE-D	2	LCL70	R01.KK.1UKC.LCL70.TM.OK.WD001	SS	MT	0.026	0.026	0.043	0.043	25.000	25.000	0.000	0.000
105	183	UKC	SCHEDULE-D	2	LCL80	R01.KK.1UKC.LCL80.TM.OK.WD001	SS/C S	MT	0.364	0.364	0.196	0.196	195.500	195.500	16.000	16.000
106	185	UKC	SCHEDULE-D	2	LCP	R01.KK.1UKC.LCP.TM.OK.WD001	SS	MT	0.823	0.823	0.425	0.425	164.000	164.000	0.000	0.000
107	186	UKC	SCHEDULE-D	2	LCQ10/LCL	R01.KK.1UKC.LCQ10.TM.OK.WD001	SS	MT	1.635	1.635	0.498	0.498	228.500	228.500	240.000	240.000
108	187	UKC	SCHEDULE-D	2	LCQ10/LCL	R01.KK.1UKC.LCQ10.TM.OK.WD002	SS	MT	2.173	2.173	0.687	0.687	191.300	191.300	348.000	348.000
109	188	UKC	SCHEDULE-D	2	LCQ50	R01.KK.1UKC.LCQ50.TM.OK.WD003	SS	MT	16.276	16.276	9.366	9.366	4524.500	4524.500	2184.000	2184.000
110	189	UKC	SCHEDULE-D	2	LCQ50	R01.KK.1UKC.LCQ50.TM.OK.WD004	SS	MT	0.695	0.695	0.441	0.441	420.500	420.500	0.000	0.000
111	190	UKC	SCHEDULE-D	2	LFG	R01.KK.1UKC.LFG.TM.OK.WD001	SS	MT	3.159	3.159	1.353	1.353	384.000	384.000	420.000	420.000
112	191	UKC	SCHEDULE-D	2	PGB60	R01.KK.1UKC.PGB 60.TM.OK.WD001	SS	MT	10.262	10.262	2.976	2.976	1764.000	1764.000	890.000	890.000
113	192	UKC	SCHEDULE-D	2	QFA	R01.KK.1UKC.QFA.TM.OK.WD001	SS	MT	0.638	0.638	0.469	0.469	347.000	347.000	0.000	0.000
114	195	UKC	SCHEDULE-D	2	QUH	R01.KK.1UKC.QUH.TM.OK.WD001	SS	MT	0.359	0.359	0.978	0.978	25.000	25.000	0.000	0.000
115	196	UKC	SCHEDULE-D	2	QUK	R01.KK.1UKC.QUK.TM.OK.WD001	SS	MT	0.617	0.617	0.988	0.988	420.000	420.000	0.000	0.000
116	197	UKC	SCHEDULE-D	2	SCB	R01.KK.1UKC.SCB.TM.OK.WD001	SS	MT	1.943	1.943	0.866	0.866	1373.000	1373.000	0.000	0.000
117	200	UKS	SCHEDULE-D	2	0FKT	R25.KK.O UKS.FKT.RO.OK.WD001	SS	MT	5.351	0.000	5.026	0.000	1184.000	0.000	0.000	0.000
118	203	UKS	SCHEDULE-D	2	0KPF	R25.KK.O UKS.KPF.RO.OK.WD002	SS	MT	1.139	0.000	0.845	0.000	530.000	0.000	20.000	0.000
119	204	UKS	SCHEDULE-D	2	0KPF	R25.KK.O UKS.KPF.RO.OK.WD003	SS	MT	3.550	0.000	3.322	0.000	796.000	0.000	24.000	0.000
120	206	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD003	SS	MT	0.457	0.000	0.379	0.000	277.000	0.000	48.000	0.000
121	207	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD004	SS	MT	4.822	0.000	4.475	0.000	583.000	0.000	419.000	0.000

Tender Specification No.: BHEL: PSSR: SCT: 1927

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122	208	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD005	SS	MT	9.344	0.000	8.874	0.000	97.000	0.000	1010.000	0.000
123	210	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD008	SS	MT	1.576	0.000	0.811	0.000	783.000	0.000	46.000	0.000
124	211	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD009	SS	MT	2.903	0.000	2.873	0.000	89.000	0.000	463.000	0.000
125	212	UKS	SCHEDULE-D	2	0KPJ	R25.KK.O UKS.KPJ.RO.OK.WD001	SS	MT	0.286	0.000	0.276	0.000	86.000	0.000	0.000	0.000
TOTAL									556	527	280	253	116780	112355	53167	51137

TECHNICAL CONDITIONS OF CONTRACT (TCC)

TENTATIVE LIST OF CS PIPING SYSTEMS WITH WEIGHT AND WELDING SCOPE																
S.no	Cust Ref no	BUILDING	SCHEDULE	ITEM NO	SYSTEM	WD NO	Material of construction	UOM	Weight of Piping		Weight of pipe supports		Small bore Inch Dia		Big Bore Inch dia	
									Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4	Unit-3	Unit-4
1	71	UJY	SCHEDULE-D	2	LBG	R01.KK.0 UJY.LBG.TM.OK.WD001	CS	MT	2.162	2.162	0.827	0.827	0.000	0.000	110.000	110.000
2	73	UJY	SCHEDULE-D	2	LCM	R01.KK.0 UJY.LCM 10.TM.OK.WD001	CS	MT	0.765	0.765	1.277	1.277	50.000	50.000	0.000	0.000
3	76	UJY	SCHEDULE-D	2	PGB	R01.KK.0 UJY.PGB.TM.OK.WD001	CS	MT	5.456	5.456	0.667	0.667	0.000	0.000	252.000	252.000
4	79	UKA	SCHEDULE-D	2	GMN	R01.KK.1 UJA.GMN..TM.OK.WD001	CS	MT	2.353	2.353	0.371	0.371	55.000	55.000	624.000	624.000
5	80	UKA	SCHEDULE-D	2	GUD	R01.KK.2 UJA.GUD.WK.OK.WD001	CS	MT	0.494	0.494	0.016	0.016	60.000	60.000	508.000	508.000
6	119	UKA	SCHEDULE-D	2	OQKJ	R01.KK.2 UJA.OQKJ.TM.OK.WD003	CS	MT	0.228	0.228	0.230	0.230	163.000	163.000	0.000	0.000
7	121	UKA	SCHEDULE-D	2	QKJ	R01.KK.2 UJA.QKJ.TM.OK.WD001	CS	MT	12.498	12.498	5.999	5.999	1857.000	1857.000	2787.000	2787.000
8	124	UKA	SCHEDULE-D	2	SCD	R01.KK.2 UJA.SCD.TM.OK.WD002	CS	MT	0.515	0.515	2.120	2.120	300.000	300.000	0.000	0.000
9	130	UKC	SCHEDULE-D	2	GMN	R01.KK.1UKC.GMN.TM.OK.WD001	CS	MT	2.413	2.413	0.093	0.093	0.000	0.000	128.000	128.000
10	131	UKC	SCHEDULE-D	2	GUD	R01.KK.1UKC.0.WK.OK.WD001	CS	MT	2.317	2.317	0.881	0.881	29.000	29.000	748.000	748.000
11	181	UKC	SCHEDULE-D	2	LBG60	R01.KK.1UKC.LBG 10-70.TM.OK.WD001	CS	MT	2.736	2.736	0.945	0.945	280.000	280.000	279.000	279.000
12	184	UKC	SCHEDULE-D	2	LCM80	R01.KK.1UKC.LCM80.TM.OK.WD001	CS	MT	1.544	1.544	1.430	1.430	1580.800	1580.800	24.000	24.000
13	193	UKC	SCHEDULE-D	2	QKK 0	R01.KK.1UKC.0QKK.TM.OK.WD002	CS	MT	22.582	22.582	4.183	4.183	4233.300	4233.300	2584.000	2584.000
14	194	UKC	SCHEDULE-D	2	QKK 1-4	R01.KK.1UKC.QKK.TM.OK.WD001	CS	MT	4.725	4.725	5.829	5.829	3464.300	3464.300	0.000	0.000
15	198	UKC	SCHEDULE-D	2	SCB	R01.KK.1UKC.SCB.TM.OK.WD002	CS	MT	2.425	2.425	2.418	2.418	2124.000	2124.000	0.000	0.000
16	199	UKC	SCHEDULE-D	2	SCC	R01.KK.1UKC.SCC.TM.OK.WD001	CS	MT	5.359	5.359	0.180	0.180	45.500	45.500	376.000	376.000
17	201	UKS	SCHEDULE-D	2	OGMA	R25.KK.0 UKS.0.WK.OK.WD002	CS	MT	0.200	0.000	0.170	0.000	0.000	0.000	16.000	0.000
18	202	UKS	SCHEDULE-D	2	OKPA	R25.KK.O UKS.KPA.RO.OK.WD002	CS	MT	1.338	0.000	0.958	0.000	432.000	0.000	0.000	0.000

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19	205	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD002	CS	MT	1.284	0.000	1.047	0.000	479.000	0.000	0.000	0.000
20	209	UKS	SCHEDULE-D	2	0KPH	R25.KK.O UKS.KPH.RO.OK.WD006	CS	MT	0.535	0.000	0.404	0.000	372.000	0.000	0.000	0.000
21	213	UKS	SCHEDULE-D	2	0KPP	R25.KK.O UKS.KPP.RO.OK.WD002	CS	MT	0.062	0.000	0.062	0.000	48.000	0.000	0.000	0.000
22	214	UKS	SCHEDULE-D	2	0LBG	R25.KK.O UKS.LBG.RO.OK.WD001	CS	MT	0.696	0.000	0.686	0.000	242.000	0.000	0.000	0.000
23	215	UKS	SCHEDULE-D	2	0PGB	R25.KK.O UKS.PGB.RO.OK.WD001	CS	MT	2.586	0.000	1.819	0.000	626.000	0.000	170.000	0.000
24	216	UKS	SCHEDULE-D	2	0QKS	R25.KK.O UKS.QKS04.OW.OK.WD001	CS	MT	4.878	0.000	3.093	0.000	1584.000	0.000	100.000	0.000
25	217	UKS	SCHEDULE-D	2	SCB	R25.KK.O UKS.SCB.RO.OK.WD001	CS	MT	0.725	0.000	0.624	0.000	258.000	0.000	0.000	0.000
TOTAL									80.87	68.57	36.33	27.47	18282.90	14241.90	8706.00	8420.00

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
1	SCHEDULE-D	4	FKT	UJY	R01.KK.0 UJY.FKT.TM.OK.WD001,002	Pipeline of decontamination solution supply	23	0.126			12	4.025
2	SCHEDULE-D	4	KPK	UJY	R01.KK.0 UJY.KPK.TM.OK.WD001	Pipelines of systems	3	0.0225				
3	SCHEDULE-D	4	LBG	UJY	R01.KK.0 UJY.LBG.TM.OK.WD001	Auxiliary steam pipeline		0			1	0.57
4	SCHEDULE-D	4	LCM10	UJY	R01.KK.0 UJY.LCM 10.TM.OK.WD001,002	Primary circuit deaerator drains pipelines in turbine hall	1	0.008				
5	SCHEDULE-D	4	LDP	UJY	R01.KK.0 UJY.LDP .TM.OK.WD001	Pipelines of spent resins from UDP regeneration and flushing systems	1	0.0037				
6	SCHEDULE-D	4	FAL	UKA	R01.KK.1 UJA.FAL.TM.OK.WD001	fuel pond water supply for purification system in UKA.	13	0.10	16	3	0	0
7	SCHEDULE-D	4	FKA	UKA	R01.KK.2 UJA.FKA.TM.OK.WD001	Pipelines of decontamination system	11	0.03	0	0	0	0
8	SCHEDULE-D	4	GMN	UKA	R01.KK.1 UJA.GMN..TM.OK.WD001	Pipelines of exhaust system from instrumentation compartments and compartments of secondary circuit	10	0.02	0	0	20	1
9	SCHEDULE-D	4	GUD	UKA	R01.KK.2 UJA.GUD.WK.OK.WD001	UJA Foundation Part (UKA) Floor at El. +5.400 Water line and Sewage Pipelines for Water collection	0		2	0	0	0
10	SCHEDULE-D	4	JMN	UKA	RO1.KK.1 UJA.JMN.TM.OK.WD002	Pipelines of spray system in UKA. Binding of emergency system pump	0		0	0	4	2
11	SCHEDULE-D	4	JMN	UKA	RO1.KK.1 UJA.JMN.TM.OK.WD003	Pipelines of spray system in UKA. Binding of emergency system pump	12	0.72	8	2	8	3
12	SCHEDULE-D	4	JMN10	UKA	RO1.KK.2 UJA.JMN10.TM.OK.WD001	Auxiliary piping of pumps JMN10-40	12	0.18	0	0	0	0
13	SCHEDULE-D	4	JNA	UKA	R01.KK.1 UJA.JNA.TM.OK.WD001	emergency and planned primary circuit cooling and fuel storage cool	57	0.59	12	3		0
14	SCHEDULE-D	4	JNA	UKA	R01.KK.1 UJA.JNA.TM.OK.WD002	emergency& planned primary circuit cooling & fuel storage pool cooling	8	0.26	0	0	24	26

TECHNICAL CONDITIONS OF CONTRACT (TCC)

15	SCHEDULE-D	4	JNA	UKA	R01.KK.1 UJA.JNA.TM.OK.WD003	system of binding chemical agents store tanks for chemical iodine	16	0.36	0	0	0	0
16	SCHEDULE-D	4	JNA10	UKA	R01.KK.1 UJA.JNA10.TM.OK.WD001	Auxiliary piping of pumps JNA10-40.	12	0.17	0	0	0	0
17	SCHEDULE-D	4	JNA80	UKA	R01.KK.1 UJA.JNA80.TM.OK.WD001	Auxiliary piping of storage tanks for the solution reagents for chemical binding	30	0.22	0	0	0	0
18	SCHEDULE-D	4	JNB	UKA	R01.KK.1 UJA.JNB.TM.OK.WD001	Binding of regenerative heat exchanger 1 JNB11- 41AC001 pipelines	17	0.22	0	0	0	0
19	SCHEDULE-D	4	JNB	UKA	R01.KK.1 UJA.JNB.TM.OK.WD002	Binding of emergency cooldown heat exchanger 2, JNB10-40AC001 pipelines	22	0.17	0	0	0	0
20	SCHEDULE-D	4	JNB	UKA	R01.KK.1 UJA.JNB.TM.OK.WD003	Binding of SG emergency cooldown pump 1 JNB10- 40AC001 pipelines	16	0.21	0	0	0	0
21	SCHEDULE-D	4	JNB10	UKA	R01.KK.1 UJA.JNB10.TM.OK.WD001	Pipelines of emergency cooling and steam generator blowdown	42	1.25	30	17		0
22	SCHEDULE-D	4	JND10	UKA	R01.KK.1 UJA.JND10.TM.OK.WD001	Pipelines of HP emergency injection system	8	0.06	12	4		0

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
23	SCHEDULE-D	4	JND10	UKA	R01.KK.1 UJA.JND10.TM.OK.WD002	Pipelines of HP emergency injection system	6	0.10	0	0	4	1
24	SCHEDULE-D	4	JND10	UKA	R01.KK.1 UJA.JND10.TM.OK.WD004	Auxiliary piping of pumps JND10-40	16	0.30	0	0	0	0
25	SCHEDULE-D	4	JND50	UKA	R01.KK.1 UJA.JND50.TM.OK.WD001	Pipelines of emergency boron injection	8	0.36	0	0	0	0
26	SCHEDULE-D	4	JND50	UKA	R01.KK.1 UJA.JND50.TM.OK.WD002	Pipelines of emergency boron injection system	12	0.95	0	0	0	0
27	SCHEDULE-D	4	JND50	UKA	R01.KK.1 UJA.JND50.TM.OK.WD004	Binding of emergency boron injection pump 1 JND50-80AP001 pipelines	8	0.15	0	0	0	0
28	SCHEDULE-D	4	KAA	UKA	R01.KK.1 UJA.KAA.TM.OK.WD001	component cooling system in UKA	160	3.53	45	9	32	41
29	SCHEDULE-D	4	KAA	UKA	R01.KK.1 UJA.KAA.TM.OK.WD003	Pipelines of component cooling system	60	1.50	0	0	0	0
30	SCHEDULE-D	4	KAA10	UKA	R01.KK.1 UJA.KAA10.TM.OK.WD001	Auxiliary piping of pumps of closed cooling water system KAA10 ... 40AP001	20	0.14	0	0	0	0
31	SCHEDULE-D	4	KAA90	UKA	RO1.KK.2 UJA.KAA 90.TM.OK.WD001	Component cooling system for reactor plant loads (cool down of zeolitic filters)	30	0.63	0	0	0	0
32	SCHEDULE-D	4	KBC10	UKA	R01.KK.1 UJA.KBC10..TM.OK.WD001	Pipelines of distillate system	0	0.00	0	0	0	0
33	SCHEDULE-D	4	KPM	UKA	R01.KK.2 UJA.KPM.TM.OK.WD001	Pipelines of radioactive process blow-off purification system.	80	1.65	0	0	0	0
34	SCHEDULE-D	4	KPM	UKA	R01.KK.2 UJA.KPM.TM.OK.WD002	Pipelines of radioactive process blow-off purification system	6	0.05	0	0	0	0
35	SCHEDULE-D	4	KTC10	UKA	R01.KK.2 UJA.KTC10.TM.OK.WD001	Pipelines of collecting system of boron -containing water from reactor systems	16	0.32	0	0	0	0
36	SCHEDULE-D	4	KTF	UKA	R01.KK.1 UJA.KTF.TM.OK.WD001	Pipelines of active floor drainage pipework system	2	0.02	0	0	0	0

TECHNICAL CONDITIONS OF CONTRACT (TCC)

37	SCHEDULE-D	4	KTF	UKA	R01.KK.1 UJA.KTF.TM.OK.WD002	Pipelines of active drainage pipework system for containment above el.+5,400	0	0.00	0	0	0	0
38	SCHEDULE-D	4	KTH	UKA	R01.KK.1 UJA.KTH.TM.OK.WD001	Pipeline of active floor drainage pipework system in UKA (delivery part)	24	0.42	0	0	0	0
39	SCHEDULE-D	4	KUA10	UKA	R01.KK.2 UJA.KUA10.TM.OK.WD001	Pipeline of compressed air system for maintenance below el.+5,400	16	0.04	0	0	0	0
40	SCHEDULE-D	4	KUJ11	UKA	R01.KK.2 UJA.KUJ11.TM.OK.WD001	Radioactive gaseous sampling systems	20	0.22	0	0	0	0
41	SCHEDULE-D	4	KWA	UKA	R01.KK.2 UJA.KWA.TM.OK.WD001	Pipelines of system for hydrotesting and blow down of I&C Sensors	4	0.01	0	0	0	0
42	SCHEDULE-D	4	KWC	UKA	R01.KK.2 UJA.KWC.TM.OK.WD001	Pipelines of hydrotesting of primary system pipelines and blowdown of I&C sensor	0	0.00	0	0	0	0
43	SCHEDULE-D	4	KWC	UKA	R01.KK.2 UJA.KWC.TM.OK.WD002	pipelines of hydrotesting of primary system pipelines and blowdown of I&C sensor	0	0.00	0	0	0	0
44	SCHEDULE-D	4	LCQ50	UKA	R01.KK.2 UJA.LCQ50.TM.OK.WD001	Pipelines of steam generator blowdown water cleaning system	80	1.20	28	6.1	0	0

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
45	SCHEDULE-D	4	LCQ50	UKA	R01.KK.2 UJA.LCQ50.TM.OK.WD002	Pipelines of steam generator blowdown water cleaning system	20	0.17	0	0	0	0
46	SCHEDULE-D	4	OQKJ	UKA	R01.KK.2 UJA.OQKJ.TM.OK.WD003	Pipelines of cold supply system for ventilation systems in conventional area	12	0.08	0	0	0	0
47	SCHEDULE-D	4	QFA	UKA	R01.KK.2 UJA.QFA.TM.OK.WD001	Pipelines of compressed air system for valve	30	0.13	0	0	0	0
48	SCHEDULE-D	4	QKJ	UKA	R01.KK.2 UJA.QKJ.TM.OK.WD001	Pipelines of cold supply system for ventilation	80	0.95	20	6	0	0
49	SCHEDULE-D	4	QUH	UKA	RO1.KK.2 UJA.QUH.TM.OK.WD001	Pipeline of compressed air system for maintenance	12	0.06	0	0	0	0
50	SCHEDULE-D	4	QUK	UKA	R01.KK.2 UJA.QUK.TM.OK.WD001	Pipelines of automated chemical monitoring system	12	0.02	0	0	0	0
51	SCHEDULE-D	4	SCD	UKA	R01.KK.2 UJA.SCD.TM.OK.WD002	Pipeline of compressed air system for maintenance	12	0.30	0	0	0	0
52	SCHEDULE-D	4	FAL	UKC	R01.KK.1UKC.FAL.TM.OK.WD001	Pipelines of fuel pool water supply for purification	29	0.3	32	5.2	4	1.4
53	SCHEDULE-D	4	FBA	UKC	R01.KK.1UKC.FBA.TM.OK.WD001	Defective assembly detection system (process part).	43	0.7				
54	SCHEDULE-D	4	FKA	UKC	R01.KK.1UKC.FKA.TM.OK.WD001	Pipeline for decontaminating the equipment an rooms	127	0.65	1	0.03		
55	SCHEDULE-D	4	FKT	UKC	R01.KK.1UKC.FKT.TM.OK.WD001	Pipeline of decontamination solution preparation	58	0.76	20	0.95	12	4
56	SCHEDULE-D	4	GUD	UKC	R01.KK.1UKC.0.WK.OK.WD001	UTILITY WASTE WATER SEWERAGE	2	0.05				
57	SCHEDULE-D	4	JEA50	UKC	R01.KK.1UKC.JEA50.TM.OK.WD001	Pipeline of steam generator level monitoring and	108	0.6				
58	SCHEDULE-D	4	JEV 50	UKC	R01.KK.1UKC.JEv50.TM.OK.WD001	pipelines for oil supply and discharge from RCPS oil tank	1	0.013				
59	SCHEDULE-D	4	JMY20	UKC	R01.KK.1UKC.JMY20.TM.OK.WD001	PIPELINES OF LEAKAGE MEASUREMENT	4	0.01				

TECHNICAL CONDITIONS OF CONTRACT (TCC)

60	SCHEDULE-D	4	KAA	UKC	R01.KK.1UKC.KAA.TM.OK.WD001,002	Pipeline for nuclear component cooling system KAA	193	1.78	4	0.3		
61	SCHEDULE-D	4	KBA	UKC	R01.KK.1UKC.KBA.TM.OK.WD001,002,003	Primary makeup and blowdown pipelines	73	1	47	9.4		
62	SCHEDULE-D	4	KBB	UKC	R01.KK.1UKC.KBB.TM.OK.WD001	Pipelines of coolant of operating storage system KBB	101	1.34	10	2.4		
63	SCHEDULE-D	4	KBC10	UKC	R01.KK.1UKC.KBC10.TM.OK.WD001	Distillate pipelines	63	0.7	30	3.2		
64	SCHEDULE-D	4	KBC40	UKC	R01.KK.1UKC.KBC40.TM.OK.WD001	Boron concentration pipelines	32	0.6	16	1.67		
65	SCHEDULE-D	4	KBD	UKC	R01.KK.1UKC.KBD.TM.OK.WD001	Pipelines of reagent supply to the primary coolant	36	0.3				
66	SCHEDULE-D	4	KBE 50-60	UKC	R01.KK.1UKC.KBE.TM.OK.WD001,002	Coolant low-temperature purification pipelines	144	2.72	29	3.3		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
67	SCHEDULE-D	4	KBF	UKC	R01.KK.1UKC.KBF.TM.OK.WD001,002	Pipeline of coolant treatment system KBF	219	3.4	13	2.05		
68	SCHEDULE-D	4	KBH	UKC	R01.KK.1UKC.KBH.TM.OK.WD001, 002	Fuel pool water purification pipelines	83	2.3	8	1.4		
69	SCHEDULE-D	4	KPC	UKC	R01.KK.1UKC.KPC.TM.OK.WD001,002	Liquid radioactive media concentrating plant KPC	10	0.2				
70	SCHEDULE-D	4	KPF	UKC	R01.KK.1UKC.KPF.TM.OK.WD001,002,003	Pipeline of floor water treatment system pipeline KPF 10-60	458	6.6	58	6.5		
71	SCHEDULE-D	4	KPJ	UKC	R01.KK.1UKC.KPJ.TM.OK.WD001	Pipelines of system of reagent preparation and supply for AWT needs	150	1.3	7	0.3		
72	SCHEDULE-D	4	KPK	UKC	R01.KK.1UKC.KPK.TM.OK.WD001	Pipeline of radioactive fluid intermediate storage system piping KPK	116	2.2	15	0.63		
73	SCHEDULE-D	4	KPL	UKC	R01.KK.1UKC.KPL.TM.OK.WD001	Pipeline of burning system for hydrogen from radioactive process KPL	67	1.1	18	1.8		
74	SCHEDULE-D	4	KPM40	UKC	R01.KK.1UKC.KPM 40.TM.OK.WD001	Reactor Auxiliary & Main control room building system for purifying blow-offs from the equipment pertaining to the liquid radioactive media.	17	0.05	18	1.2		
75	SCHEDULE-D	4	KPN	UKC	R01.KK.1UKC.KPN.TM.OK.WD001,002	Liquid radioactive media cementation plant KPN	100	1.5	2	0.14		
76	SCHEDULE-D	4	KRA	UKC	R01.KK.1UKC.KRA.TM.OK.WD001	Pipelines of nitrogen supply to blow offs from reactor equipment KRA 10-20	88	1				
77	SCHEDULE-D	4	KTA	UKC	R01.KK.1UKC.KTA.TM.OK.WD001	Primary drains and controlled leaks pipelines	27	0.3	13	1.04		
78	SCHEDULE-D	4	KTB	UKC	R01.KK.1UKC.KTB.TM.OK.WD001	Gas blow - offs pipelines	14	0.2				
79	SCHEDULE-D	4	KTC	UKC	R01.KK.1UKC.KTC10.TM.OK.WD001	Pipeline of collecting system of boron-containing water from reactor KTC 10-20	5	0.07				

TECHNICAL CONDITIONS OF CONTRACT (TCC)

80	SCHEDULE-D	4	KTH	UKC	R01.KK.1UKC.KTH.TM.OK.WD001	Pipeline of active floor drainage system, Pressure pipeline (KTH)	17	0.5	7	0.7		
81	SCHEDULE-D	4	KUA	UKC	R01.KK.1UKC.KUA10.TM.OK.WD001	Reactor building equipment sampling system	80	0.5				
82	SCHEDULE-D	4	KUE	UKC	R01.KK.1UKC.KUE.TM.OK.WD001,002	Sampling system for purification plant	105	0.3				
83	SCHEDULE-D	4	KUJ	UKC	R01.KK.1UKC.KUJ11.TM.OK.WD001	Pipelines of sampling system for gaseous radioactive mediums	51	0.73				
84	SCHEDULE-D	4	KWA	UKC	R01.KK.1UKC.KWA.TM.OK.WD001	System of I&C transducers hydraulic testing and flushing by distillate	23	0.2				
85	SCHEDULE-D	4	KWB	UKC	R01.KK.1UKC.KWB50.TM.OK.WD001	Secondary SG hydraulic testing pipelines	17	0.15				
86	SCHEDULE-D	4	KWC	UKC	R01.KK.1UKC.KWC.TM.OK.WD001,002	Pipeline for hydraulic tests and purging I&C sensors with distillate water KWC	101	0.9				
87	SCHEDULE-D	4	LBG60	UKC	R01.KK.1UKC.LBG 10-70.TM.OK.WD001	Auxiliary steam pipelines LBG 10-70		0	2	0.35	1	0.6
88	SCHEDULE-D	4	LCL80	UKC	R01.KK.1UKC.LCL80.TM.OK.WD001	Auxiliary reactor building with MCR SG draining pipelines at the increased parameters LCL80	2	0.0012	6	0.5		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
89	SCHEDULE-D	4	LCM80	UKC	R01.KK.1UKC.LCM80.TM.OK.WD001	Pipelines of turbine hall drain piping (condensate collection and return for active water return) LCM 80-90	47	1.2	3	0.09		
90	SCHEDULE-D	4	LCP	UKC	R01.KK.1UKC.LCP.TM.OK.WD001	Turbine hall DM water system LCP		0				
91	SCHEDULE-D	4	LCQ10/LCL	UKC	R01.KK.1UKC.LCQ10.TM.OK.WD001,002	SG drains and blowdown pipelines	9	0.066	8	1.32		
92	SCHEDULE-D	4	LCQ50	UKC	R01.KK.1UKC.LCQ50.TM.OK.WD003,004	SG blowdown water purification pipelines	233	4	30	4		
93	SCHEDULE-D	4	LFG	UKC	R01.KK.1UKC.LFG.TM.OK.WD001	SG chemical flushing pipelines	60	0.2	10	1.05		
94	SCHEDULE-D	4	PGB60	UKC	R01.KK.1UKC.PGB 60.TM.OK.WD001	Pipeline of normal operation component cooling system (PGB 00-70)	111	1.08	8	0.162		
95	SCHEDULE-D	4	QFA	UKC	R01.KK.1UKC.QFA.TM.OK.WD001	Pipeline of compressed air s/s pipeline for pneumatically driven calves (QFA)	16	0.5				
96	SCHEDULE-D	4	QKK	UKC	R01.KK.1UKC.0QKK.TM.OK.WD002	Pipeline of chill supply system for the conventional component ventilation 0 QKK	294	3.5	35	2.5	4	1.05
97	SCHEDULE-D	4	QUH	UKC	R01.KK.1UKC.QUH.TM.OK.WD001	Secondary sampling pipelines	44	0.12				
98	SCHEDULE-D	4	QUK	UKC	R01.KK.1UKC.QUK.TM.OK.WD001	Pipelines of ACM of secondary circuit chemistry	42	0.09				
99	SCHEDULE-D	4	SCB	UKC	R01.KK.1UKC.SCB.TM.OK.WD001,002	Compressed air pipelines for technological needs	88	0.15				
100	SCHEDULE-D	4	SCC	UKC	R01.KK.1UKC.SCC.TM.OK.WD001	Pipeline for compressed air supply system for containment SCC	1	0.0025	2	0.2	1	0.8
101	SCHEDULE-D	4	0FKT	UKS	R25.KK.0 UKS.FKT.RO.OK.WD001	Decontamination pipelines	47	0.31	0	0	0	0
102	SCHEDULE-D	4	0GMA	UKS	R25.KK.0 UKS.0.WK.OK.WD002	Oil containing water sewerage system	0	0.00	1	0.036	0	0

TECHNICAL CONDITIONS OF CONTRACT (TCC)

103	SCHEDULE-D	4	0KPA	UKS	R25.KK.O UKS.KPA.RO.OK.WD002	Emergency oil discharge pipelines	10	0.42	0	0	0	0
104	SCHEDULE-D	4	0KPF	UKS	R25.KK.O UKS.KPF.RO.OK.WD002	Pipeline of floor water collecting system	21	0.30	0	0	0	0
105	SCHEDULE-D	4	0KPF	UKS	R25.KK.O UKS.KPF.RO.OK.WD003	Radiation sewerage pipelines	17	0.23	0	0	0	0
106	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD002	Diesel fuel pipelines	41	0.24	0	0	0	0
107	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD003	Flushing solution pipelines	19	0.08	0	0	0	0
108	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD004	Air pipelines into vent skip	19	0.09	5	0.259	0	0
109	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD005	Smoke gases pipeline	6	0.03	17	0.438	0	0
110	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD006	Pump over flow and drainage pipelines	26	0.13	0	0	0	0

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SYSTEM & BUILDING WISE TENTATIVE LIST OF VALVES												
Note: (1) The quantity mentioned below is indicative based on the quantity of KKNPP Unit-1&2.												
(2) The quantities of KKNPP Unit-3&4 is subject to change.												
SR NO	SCHEDULE	ITEM NO	SYSTEM	BUILDING	DRAWING NO	DESCRIPTION	Valves (D<=50NB)		Valves (50NB<D<=200NB)		Valves (D>200NB)	
							Nos	Weight (MT)	Nos	Weight (MT)	Nos	Weight (MT)
111	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD008	Flushing solution pipelines	32	0.36	2	0.41	0	0
112	SCHEDULE-D	4	0KPH	UKS	R25.KK.O UKS.KPH.RO.OK.WD009	Process relief pipelines	6	0.03	0	0	0	0
113	SCHEDULE-D	4	0KPJ	UKS	R25.KK.0 UKS.KPJ.RO.OK.WD001	20% alakali pipelines	8	0.03	0	0	0	0
114	SCHEDULE-D	4	0KPP	UKS	R25.KK.0 UKS.KPP.RO.OK.WD002	Installation drawings of grinding facility	1	0.001	0	0	0	0
115	SCHEDULE-D	4	0LBG	UKS	R25.KK.0 UKS.LBG.RO.OK.WD001	Pipelines of steam & materials	16	0.08	0	0	0	0
116	SCHEDULE-D	4	0PGB	UKS	R25.KK.O UKS.PGB.RO.OK.WD001	Intermediate loop pipelines of normal operation consumers	57	0.29	4	0.482	0	0
117	SCHEDULE-D	4	0QKS	UKS	R25.KK.0 UKS.QKS04.OW.OK.WD001	Cold air supply pipeline to Plenum facilities	70	1.47	2	0.22	0	0
118	SCHEDULE-D	4	SCB	UKS	R25.KK.O UKS.SCB.RO.OK.WD001	Compressed air pipelines	27	0.10	0	0	0	0
TOTAL								68.11		105.62		86.67

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – II CHAPTER 1

CORRECTIONS / REVISIONS IN SPECIAL CONDITIONS OF CONTRACT, GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

SI No: 1

Clause 4.1.11 of SCC is deleted.

SI No: 2:

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME

The following clauses in Occupational Health, Safety & Environment Management / Quality Assurance Programme published in Chapter-IX of Special Conditions of Contract (Volume I Book-II) is revised as under.

Chapter IX Clause 9.1 is modified as below:

Contractor will comply with HSE (Health, Safety & Environment) requirements of BHEL as per the “HSE Plan for Site Operations by Subcontractor” (Document No. HSEP: 14 Rev01) enclosed.

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

SI No: 3:

Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume-IB, Book-II, is revised as under:

The payment for running bills will normally be released within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc., and other dues in the meanwhile.

SI No: 4

The EARNEST MONEY DEPOSIT (EMD) clause 1.9 published in General Conditions of Contract (Volume I Book-II) is revised as under.

1.9 EARNEST MONEY DEPOSIT

- 1.9.1 Every tenderer must furnish the prescribed amount of Earnest Money Deposit (EMD) to BHEL PSSR, only in the following forms: -
- i. Electronic Fund Transfer credited in BHEL account (before tender opening).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- ii. Through Online EMD payment portal, before tender opening, by following these steps.
 1. Visit www.onlinesbi.com -> Go to State Bank Collect (In the tab section)
 2. Click Check box to proceed for payment -> Click on Proceed
 3. Under State of Corporate/Institution -> Select Tamilnadu
 4. Under Type of Corporate/Institution -> Select PSU – Public Sector Undertaking -> Go
 5. Under PSU – Public Sector Undertaking Name -> Select BHEL PSSR CHENNAI and Submit
 6. Under Select Payment Category -> SCT Tender EMD & Tender Fees
- iii. Banker's cheque or Pay order or Demand Draft in favour of 'Bharat Heavy Electricals Limited' (along with offer) and payable at Chennai.
- iv. Fixed Deposit Receipt (FDR) issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL) along with the offer.
- v. In case EMD amount is more than Rs. Two Lakhs, Tenderer has the option to submit Rs. Two lakhs in the forms described above in clause no. 1.9.1. (i) to (iv) and the remaining amount over and above Rs. Two Lakhs in the form of Bank Guarantee from Scheduled Bank (along with the Offer).

Note:

- a) Proforma for Bank Guarantee for EMD- Form WAM 23 is enclosed with this Tender in Volume-1A Part II Chapter 9.
- b) The Bank Guarantee shall be valid for at least six months from the due date of tender submission mentioned in the Notice Inviting Tender.
- c) Date of Expiry of Claim shall be as given in Proforma of Bank Guarantee (in lieu of Earnest Money)-Form WAM 23.

Bank Details for the purpose of Taking EMD BG

Name and Address of Beneficiary:	Bharat Heavy Electricals Ltd. Tek Towers, No.11, Old Mahabalipuram Road, Okkiyam Thoraipakkam, Chennai - 600097.
Name of Bank of Client :	State Bank Of India
Bank Branch Address:	SBI Saidapet Branch, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 600035
IFSC Code :	SBIN0000912
Account No. :	10610819499

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Details for SFMS (Structured Financial Messaging System) transmission of BG

Bank Branch	and	SBI TFCPC Branch
Branch Code		5056
IFSC Code		SBIN0005056

- 1.9.2 EMD shall not carry any interest.
- 1.9.3 EMD by the Tenderer will be forfeited as per NIT Conditions, if:
- i. After opening the tender and within the offer validity period, the Tenderer revokes his tender or makes any modification in his tender which is not acceptable to BHEL.
 - ii. The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/Contract
- 1.9.4 EMD given by all unsuccessful tenderers will be refunded normally within 15 days of award of work.
- 1.9.5 EMD of successful tenderer will be retained as part of Security Deposit.
- 1.9.6 EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged under the provisions of extant" Guidelines on Suspension of Business dealings with suppliers/contactors" and forfeited / released based on the action determined under these guidelines.

SI No: 5

SECURITY DEPOSIT: The SECURITY DEPOSIT (SD) clause 1.10 published in General Conditions of Contract (Volume I Book-II) is revised as under.

1.10 Security Deposit:

- 1.10.1 Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit for satisfactory completion of work, as given below:
- 1.10.2 The total amount of Security Deposit will be 5% of the contract value. EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.
- 1.10.3 The security Deposit should be furnished before start of the work by the contractor.
- 1.10.4 Modes of deposit:
- 1.10.4.1 The balance amount to make up the required Security Deposit of 5% of the contract value may be furnished in any one of the following forms
- i. Cash (as permissible under the extant Income Tax Act)

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- ii. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL
- iii. Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats.
- iv. Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL, duly discharged on the back.
- v. Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL and discharged on the back)

(Note: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith)

- 1.10.5 At least 50% of the Security Deposit including the EMD should be deposited in any form as prescribed before start of the work and the balance 50% of the Security Deposit will be recovered by deducting 10% of the gross amount progressively from each running bills of the contractor till the total amount of the required Security Deposit is collected.
- 1.10.6 The recoveries made from running bills (cash deduction towards balance SD amount) will be released against submission of equivalent Bank Guarantee in the prescribed formats, but only once, before completion of work.
- 1.10.7 The Security Deposit shall not carry any interest.
- 1.10.8 If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the excess Security Deposit due the enhancement shall be immediately deposited by the Contractor or recovered from payment/s due to the Contractor.
- 1.10.9 The validity of Bank Guarantees towards Security Deposit shall be initially upto the completion period as stipulated in the Letter of Intent/Award + 3 months, and the same shall be kept valid by proper renewal till the acceptance of Final Bills of the Contractor, by BHEL Date of Expiry of Claim shall be as given in the prescribed formats for Bank Guarantee towards Security Deposit.
- 1.10.10 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of

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contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

1.10.11 Penalty for Delayed Remittance of Security Deposit

If the contractor fails to furnish SD before start of work, in line with 1.10.3 above,

Simple Interest against delayed remittance of the Security Deposit shall be deducted from the sub-contractor at the rate of SBI PLR + 2% on the value of 50% SD of the contract, for the delayed period (i.e., period between start of work and date of remittance of Initial SD, i.e., atleast 50% of SD). In case, the delayed period has different SBI PLR rates, Simple Interest shall be calculated based on different rates by considering the corresponding time period. On similar lines Penalty shall be levied for delayed remittance of Additional Security Deposit (if applicable).

Note: - Bank details & SFMS details provided above in SI. No. 04 Earnest Money Deposit) may be used for the purpose of arranging Bank Guarantees towards Security Deposit / Additional Security Deposit also.

SI No: 6

Clause 2.7.1, 2.7.2 and 2.7.3 in GCC regarding Rights of BHEL is revised as under:

2.7.1 In case of inadequate manpower deployed by the contractor, BHEL reserves the right to deploy additional manpower through any other agency for expediting the activities in the interest of the project. Supplied manpower shall be put on job by the contractor and payments and other statutory compliances related to manpower shall be the contractor's responsibility. In case of contractor's failure to fulfill his obligations in respect of manpower, BHEL reserves the right to take necessary action as per contract obligations. To withdraw any portion of work and / or to restrict / alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons / BHEL's obligation to its customer.

2.7.2.

2.7.2.1 To terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor after due notice of a period of 14 days' by BHEL in any of the following cases:

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- i. Contractor's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution.
- ii. Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.
- iii. Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor.
- iv. Termination of Contract on account of any other reason (s) attributable to Contractor.
- v. Assignment, transfer, subletting of Contract without BHEL's written permission.
- vi. Non-compliance to any contractual condition or any other default attributable to Contractor.

Risk & Cost Amount against Balance Work:

Risk & Cost amount against balance work shall be calculated as follows:

$$\text{Risk \& Cost Amount} = [(A-B) + (A \times H/100)]$$

Where,

A= Value of Balance scope of Work (*) as per rates of new contract

B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time of termination of contract i.e. inclusive of PVC & ORC, if any.

H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

* Balance scope of work (in case of termination of contract):

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for

'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount. Contract quantities are the quantities as per original contract.

If, Contract has been amended,

quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items

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total Quantities as per issued drawings would be deemed to be contract quantities. Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose. Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: Incase portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk & Cost amount.

LD against delay in executed work in case of Termination of Contract:

LD against delay in executed work shall be calculated in line with LD clause no. 2.7.9 of GCC, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of "LD against delay in executed work in case of termination of contract" is given below.

- i). Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
- ii). Let the value of executed work till the time of termination of contract= X
- iii). Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
- iv). Delay in executed work attributable to contractor i.e. $T2 = [1 - (X/Y)] \times T1$
- v). LD shall be calculated in line with LD clause (clause 2.7.9) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

- 2.7.2.2 In case Contractor fails to deploy the resources as per requirement, BHEL can deploy own/hired/otherwise arranged resources at the risk and cost of the contractor and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.

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2.7.3 **Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor**

Following sequence shall be applicable for recoveries from contractor:

- a) Dues available in the form of Bills payable to contractor, SD, BGs against the same contract.
- b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.
- c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery:
 - i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery.
 - ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor.
 - iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

SL No: 7

In addition to clause 2.7.9 of General Conditions of Contract (GCC), a New clause 2.7.9.1 is added as below.

2.7.9.1 Penalty for Intermediate Milestones

- 2.7.9.1.1 M1 and M2 shall be intermediate Milestones for this work.
- 2.7.9.1.2 In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to Form 14.
- 2.7.9.1.3 Incase delay in achieving M1 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to Maximum 2% of executable contract value will be withheld.
- 2.7.9.1.4 Incase delay in achieving M2 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to maximum 3% of executable contract value will be withheld.

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- 2.7.9.1.5 Amount already withheld, if any, against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 milestone.
- 2.7.9.1.6 Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
- 2.7.9.1.7 Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.
- 2.7.9.1.8 In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.

Note: *Executable contract value-value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

SL No: 8

OVERRUN COMPENSATION (ORC)

The **OVERRUN COMPENSATION (ORC)** clause 2.12 published in General Conditions of Contract (Volume I Book-II) is revised as under.

2.12 OVERRUN COMPENSATION (ORC)

- 2.12.1 **ORC during original contract period:** No ORC shall be applicable during the original contract period.
- 2.12.2 **ORC during extended period for the reasons solely attributable to contractor:** No ORC shall be applicable during the extended period granted for the reasons solely attributable to contractor and work executed during this period shall be paid as per original contract rates.
- 2.12.3 **ORC during extended period for the reasons not attributable to contractor:** ORC shall be payable as per following procedure:
 - 2.12.3.1 For initial period of twelve months of extended period, ORC rate applicable over executed value shall be 5%. For every subsequent period of twelve months, ORC rate

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shall be further increased by 5% over the previous rate. For example, ORC rates applicable for initial period of 12 months and subsequent period of 12 months are given below.

Sl. No.	Extended Period for the reasons attributable to BHEL	ORC rate applicable over executed value
1	First 12 months	5%
2	13 th -24 th month and so on	10.25% $\{[(1.05 \times 1.05)-1] \times 100\}$

This process of increasing ORC rate for each subsequent period of 12 months shall continue till applicability of ORC.

2.12.3.2 On completion of original contract period as well as on completion of each subsequent period of twelve months i.e. at the time of change in applicable ORC rate, Delay Analysis shall be carried out and percentage shortfall attributable to both BHEL & Contractor shall be calculated.

2.12.3.3 For the purpose of calculation of ORC, executed value of work in the month shall be divided in Part-1 and Part-2 in proportion of percentage shortfall attributable to BHEL and contractor respectively, based on the last delay analysis as worked out in 2.12.3.2.

ORC shall be payable only on Part-1 and no ORC shall be payable on Part-2.

Value of Part-1 shall be further limited to the value of actual inputs provided by BHEL i.e. "Plan - Shortfall attributable to BHEL" for the month, as per Form-14 for calculation of ORC.

2.12.3.4 Payment of ORC amount shall be further regulated as follows:

- (i) 50% of the ORC is allocated for deployment of matching resources (with weightages) agreed as per the joint programme drawn vide 2.11.4. ORC Payment against resources shall be calculated in proportion to percentage of resources actually deployed w.r.t. planned resources, as per Form-14.
- (ii) 50% of ORC is allocated for achieving of planned progress agreed as per the joint programme drawn vide 2.11.4. ORC Payment shall be reduced in proportion to percentage shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month, as per Form-14.

2.12.3.5 The maximum amount of ORC payable for the month shall be limited to Rs. 5,00,000/-

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- 2.12.3.6 In case, there is no shortfall attributable to contractor for the month and also contractor has deployed the resources as agreed in Form-14 but ORC amount payable for the month worked out as per procedure mentioned in clause 2.12.3.3, 2.12.3.4 and 2.12.3.5, is less than Rs.1,00,000/-, then ORC amount payable for the month shall be Rs.1,00,000/- otherwise ORC amount payable for the month shall remain same.
- 2.12.3.7 In case execution is on **HOLD** (Other than Force Majeure), ORC shall be payable as per following:
- i). Contractor has not been permitted by BHEL to de-mobilize
 - a) ORC amount of Rs. 1,00,000/- per month shall be applicable during the period of HOLD provided resources as planned are deployed (not demobilized) during the period of hold.
 - b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.
 - ii). Contractor has been permitted to demobilize and to remobilize after lifting of HOLD
 - a) No ORC shall be payable to contractor for the period of HOLD.
 - b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.
- 2.12.3.8 In case **Force Majeure** is invoked:
- i). No ORC shall be applicable during the period of Force Majeure.
 - ii). Subsequent to revocation of Force Majeure, period of Force Majeure shall be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.
- 2.12.4 Applicability of ORC: ORC shall not be applicable for following activities.
- (i) Area cleaning, removal of temporary structures and return of scrap.
 - (ii) Punch list points / pending points liquidation pending due to reasons attributable to contractor
 - (iii) Submission of "As built Drawing"
 - (iv) Material Reconciliation
 - (v) Completion of Contract Closure formalities like HR Clearance/ No dues from various dept./ Statutory Authorities etc.
- 2.12.5 Total Over Run Compensation shall be limited to 10% of the cumulatively executed contract value till the month (excluding Taxes and Duties if payable extra). For this purpose, executed contract value excludes PVC, ORC and Extra/Supplementary Works.

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SI No: 9

Clauses 2.13.1, 2.13.6 & 2.13.7 in GCC on Interest Bearing Recoverable Advances,

- 9.1 Clauses 2.13.1, 2.13.6 & 2.13.7 in GCC is revised as under:
- 9.1.1 Clause 2.13.1 in GCC is revised as "Normally no advance payment shall be payable to the contractor. Mobilization advance payment in exceptional circumstances shall be interest bearing and secured through a Bank Guarantee and shall be limited to a maximum of 5% of contract value. This 'Interest Bearing Recoverable Advance' shall be payable in not less than two installments with any of the installment not exceeding 60% of the total eligible advance".
- 9.1.2 Clause 2.13.6 in GCC is revised as "The rate of interest applicable for the above advances shall be the Base rate of State Bank of India prevailing at the time of disbursement of the advance + 6%, and such rate will remain fixed till the total advance amount is recovered".
- 9.1.3 Clause 2.13.7 in GCC is revised as "Unadjusted amount of advances paid shall not exceed 5% of the total contract value at any point of time. Recovery of advances shall be made progressively from each Running Bill such that the advance amounts paid along with the interest is fully recovered by the time the contractor's billing reaches 90% of contract value."

Sl. No: 10: Void

SI No: 11

PRICE VARIATION COMPENSATION (PVC)

The PRICE VARIATION COMPENSATION (PVC) clause 2.17 published in General Conditions of Contract (Volume I Book-II) is revised as under.

2.17 PRICE VARIATION COMPENSATION

- 2.17.1 In order to take care of variation in cost of execution of work on either side, due to variation in the index of LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS, Price Variation Formula as described herein shall be applicable (for works executed during contract period and for works executed during extended period, if any, subject to other conditions as described in this section).
- 2.17.2 **85%** component of executed Contract Value shall be considered for PVC calculations and remaining 15% shall be treated as fixed component. The basis for

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calculation of price variation in each category, their component, Base Index, shall be as under:

Sl. No	CATEGORY	BASE INDEX	PERCENTAGE COMPONENT ('K')				
			CIVIL PACKAGES (See Note A/B/C)			MECHANICAL PACKAGES	Electrical, C&I, Material Management / Handling and other labour oriented packages
			A	B**	C		
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	40	25	30	65	80
ii)	HIGH SPEED DIESEL OIL	Name of Commodity: HSD Commodity code: 1202000005 (See Note E)	5	3	5	5	5
iii)	WELDING ROD	Name of Commodity: MANUFACTURE OF BASIC METALS Commodity code: 1314000000 (See Note E)				15	
iv)	CEMENT	Name of Commodity: ORDINARY PORTLAND CEMENT Commodity code: 1313050003 (See Note E)		20	30		
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity: MILD STEEL: LONG PRODUCTS Commodity code: 1314040000 (See Note E)		25			
vi)	ALL OTHER MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Commodity code: 1000000000 (See Note E)	40	12	20		

Note: A) Cement & Steel: Free Issue (BHEL Scope)

B) Cement & Steel: In Contractor Scope

C) Cement in Contractor Scope, and Steel is Free Issue (BHEL Scope)

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D) For Composite packages (i.e. Civil + Mechanical + Electrical and / or CI or Civil + Mechanical or Mechanical + Electrical and / or CI), the Component ('K') for various categories shall be as per respective packages as above

E) As per the 'MONTHLY WHOLE SALE PRICE INDEX' for the respective Commodity and Type, published by Office of Economic Adviser, Ministry of Commerce and Industry, Government of India. (Website: http://www.eaindustry.nic.in/download/data_0405.asp). Revisions in the index or commodity will be re adjusted accordingly.

2.17.3 **Void**

2.17.4 Payment / recovery due to variation in index shall be determined on the basis of the following notional formula in respect of the identified component ('K') viz LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS.

$$P = K \times R \times \frac{(X_N - X_0)}{X_0}$$

Where

P = Amount to be paid/recovered due to variation in the Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials

K = Percentage component ('K') applicable for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials

R = Value of work done for the billing month (Excluding Taxes and Duties if payable extra)

XN = Revised Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials for the billing month under consideration

Xo = Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials as on the Base date.

2.17.5 **Base date shall be calendar month of actual commencement of work at site.**

2.17.6 PVC shall not be payable for the ORC amount, Supplementary / Additional Items, Extra works. However, PVC will be payable for items executed under quantity variation of BOQ items under originally awarded contract.

2.17.7 The contractor shall furnish necessary monthly bulletins in support of the requisite indices from the relevant websites along with his Bills.

2.17.8 The contractor will be required to raise the bills for price variation payments on a monthly basis along with the running bills irrespective of the fact whether any increase/decrease in the index for relevant categories has taken place or not. In case there is delay in publication of bulletins (final figure), the provisional values as

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published can be considered for payments and arrears shall be paid/recovered on getting the final values.

- 2.17.9 PVC shall be applicable for works executed during contract period and for works executed during extended period, if any, and for the portion of work delayed/backlog for the reasons not attributable to the contractor.

However, the total Quantum of Price Variation Amount payable/recoverable shall be regulated as follows:

- i) For the portion of shortfall/backlog not attributable to contractor, PVC shall be worked out on the basis of indices applicable for the respective month in which work is done. Base index shall be applicable as defined in clause 2.17.5
- ii) In case of Force Majeure, the PVC shall be regulated as per (a) or (b) below.
 - a) Force Majeure is invoked before “Base Date” / “revised base date” (as explained below) OR immediately after “base date” / “revised base date” in continuation (i.e. during the period when PVC is not applicable):
 - vii. Base date shall be revised: Revised Base date = Previous base date + duration of Force Majeure.
No PVC will be applicable for the work done till revised base date.
 - viii. PVC will be applicable for the work done after “base date”/“ revised date” as the case may be (during extended period when delay is not attributable to contractor). PVC shall be worked out on the basis of indices applicable for the respective month in which work is done with base index as on “base date”/ “revised base date” as the case may be.
 - b) Force Majeure is invoked after “base date”/ “revised base date” as the case may be (during extended period when delay is not attributable to contractor).
 2. PVC shall be applicable for the work done after revocation of Force Majeure.
 3. PVC for the work done after revocation of Force Majeure shall be worked out on the basis of indices applicable for the respective month on which work is done excluding the effect of change in indices during total period of Force Majeure(s) invoked after “base date” / “revised base date” as the case may be. Base index shall be taken as on “base date” / “revised base date” as the case may be.

The total amount of PVC shall not exceed 15% of the cumulatively executed contract value. Executed Contract value for this purpose is exclusive of PVC, ORC, Supplementary / Additional items and Extra works except items due to quantity variation

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SI No: 12

Clauses 2.21 in GCC regarding Arbitration is amended as below

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

2.21.1.1 Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause 2.21.2 herein below or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, commence arbitration in respect of such Dispute by issuance of a notice in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice'). The Notice shall contain the particulars of all claims to be referred to arbitration in sufficient detail and shall also indicate the monetary amount of such claim. The arbitration shall be conducted by a sole arbitrator to be appointed by the Head of the BHEL Power Sector Region issuing the Contract within 60 days of receipt of the complete Notice. The language of arbitration shall be English.

The Arbitrator shall pass a reasoned award.

Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder as in force from time to time shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be **Chennai** (the place from where the contract is Issued). The Contract shall be governed by and be construed as per provisions of the laws of India. Subject to this provision 2.21.1.1 regarding ARBITRATION, the principal civil court exercising ordinary civil jurisdiction over the area where the seat of arbitration is located shall have exclusive jurisdiction over any DISPUTE to the exclusion of any other court.

2.21.1.2 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

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In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution of CPSEs Disputes) as mentioned in DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22-05-2018 as amended from time to time.

2.21.1.3 The cost of arbitration shall initially be borne equally by the Parties subject to the final allocation thereof as per the award/order passed by the Arbitrator.

2.21.1.4 Notwithstanding the existence of any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition in a professional manner unless the dispute inter-alia relates to cancellation, termination or short-closure of the Contract by BHEL.

2.21.2 CONCILIATION:

If at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract), which the Parties are unable to settle mutually, arise inter-se the Parties, the same may, be referred by either party to Conciliation to be conducted through Independent Experts Committee (IEC) to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators.

Notes:

1. No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.
2. Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.

The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in Procedure 2.3 enclosed in Vol 1A Part II. The Procedure 2.3 together with its Formats

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will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in this GCC.

The Contractor hereby agrees that BHEL may make any amendments or modifications to the provisions stipulated in the Procedure 2.3 enclosed in Vol 1A Part II from time to time and confirms that it shall be bound by such amended or modified provisions of the Procedure 2.3 with effect from the date as intimated by BHEL to it.

2.21.3 No Interest payable to Contractor

Notwithstanding anything to the contrary contained in any other document comprising in the Contract, no interest shall be payable by BHEL to Contractor on any moneys or balances including but not limited to the Security Deposit, EMD, Retention Money, RA Bills or the Final Bill, or any amount withheld and/or appropriated by BHEL etc., which becomes or as the case may be, is adjudged to be due from BHEL to Contractor whether under the Contract or otherwise.

SI No: 13: Reverse Auction

The chapter Reverse auction procedure published in Forms and Procedures' of Volume I Book-II stands deleted. **Reverse Auction is not applicable for this tender.**

SI No: 14

Existing format on Monthly Performance Evaluation of Contractor, as available in Form No F-14 of Volume ID Forms and procedure stands Deleted. Form No.- F-14 (Rev 01) is enclosed.

SI No: 15

Existing format on Monthly Performance Evaluation of Contractor, as available in Form No F-15 of Volume ID Forms and procedure stands Deleted. Form No.- F-15 (Rev 02) is enclosed.

SI No:16

Clause 2.22 in GCC regarding Retention Amount is revised as under:

2.22 Performance Security Deposit

2.22.1 After award of work, Vendor shall submit 5% of the contract value towards Performance Security Deposit, in the form of (a) or (b) below.

(a) CASH (DD/ Online payment), 5% of the contract Value towards Performance Security Deposit, before commencing the contract

(or)

(b) Recovery 5% from Each Running Bill towards Performance security deposit.

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(Note: Subcontractor has to choose either Option (a) or (b) before issue of Detailed LOI).

- (c) However, Performance Security Deposit on part of PVC will be recovered at the rate of 5% from every running bill towards performance security deposit.

2.22.2 Refund of Performance Security Deposit:

- a) 50% of Performance Security Deposit shall be released along with the final bill.
- b) Balance 50% will be released after completion of Performance Guarantee Period (i.e., after expiry of Guarantee period), provided all the defects noticed during the guarantee period have been rectified to the satisfaction of BHEL Site Engineer/ BHEL Construction Manager, and after deducting all expenses/ other amounts due to BHEL under the contract/ other contracts entered into by BHEL with them. This portion of Performance Security Deposit, amount can be released on commencement of the Guarantee Period, on submission of equivalent Bank Guarantee.

The performance security deposit mentioned herein above, is in addition to Security Deposit as per SI No. 5 above.

SI No: 17

Existing format for Integrity Pact, as available in Volume ID Forms and procedure stands Deleted. Revised Format is enclosed in NIT.

SI No: 18

Existing format for BANK GUARANTEE FOR SECURITY DEPOSIT, as available in Form No. F-11 (Rev 00) of Volume ID Forms and procedures stands deleted. Refer Proforma of Bank Guarantee (in lieu of Security Deposit)-Form WAM 22 provided in Chapter-10, Part-II of Volume-IA Technical Conditions of Contract.

SI No: 19

Clause 2.15.5 of GCC in Extra Works is revised as under:

2.15.5: After eligibility of extra works is established and finally accepted by BHEL engineer / designer, payment will be released on competent authority's approval at the following rate.

MAN-HOUR RATE FOR ELIGIBLE EXTRA WORKS:

Single composite average labour man-hour rate, including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals, consumables for carrying out

TECHNICAL CONDITIONS OF CONTRACT (TCC)

any major rework / repairs / rectification / modification / fabrication as certified by site as may arise during the course of erection, testing, commissioning or extra works arising out of transit, storage and erection damages, payment, if found due will be at Rs 108/- per man hour.

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VOLUME-IA PART – II

CHAPTER 2-9

In the next 379 pages as below:

CHAPTER	Details	No. of sheets
CHAPTER 2	Technical Specification and scope of work detailed	244
CHAPTER 3	HSE Plan For Site Operations By Subcontractor	82
CHAPTER 4	Form 15 Rev 02	06
CHAPTER 5	Form 14 Rev 01	06
CHAPTER 6	Proforma Of Bank Guarantee (In Lieu Of Earnest Money)- Form WAM 23	03
CHAPTER 7	Proforma Of Bank Guarantee (In Lieu Of Security Deposit)-Form WAM 22	03
CHAPTER 8	Procedure For Conduct Of Conciliation Proceedings	11
CHAPTER 9	Drawings	24

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VOLUME-IA PART- II CHAPTER-2

TECHNICAL SPECIFICATION & SCOPE OF WORK DETAILED

TABLE OF CONTENTS

S.NO	CATEGORY	DESCRIPTION
2.2.1	Static	Erection, Alignment, Fit Up and Welding of Static Equipment
2.2.2	Static	Dismantling, shifting, re-assembly, erection, alignment of plate type Heat exchanger
2.2.3	Rotary	Handling, Shifting, Erection, Alignment, Inspection of Rotary Equipment
2.2.4	Piping	Handling, erection, welding and inspection of carbon steel and Stainless-steel piping
2.2.5	Piping	Welding for NIEP erection package works
2.2.6	NDT	Radiography for NIEP erection package works
2.2.7	NDT	UT for NIEP erection package works
2.2.8	NDT	LPT for NIEP erection package works
2.2.9	Valves	Handling, testing, erection of valves
2.2.10	Valves	Supply, fabrication, erection, welding, testing of drive mechanism for remote drive valves
2.2.11	O-let	Erection, Welding and Drilling Of O-Let (Boss) On Pipe Spools at Shop and In-Situ
2.2.12	Orifice	Erection, alignment, fit up and welding of orifice in reactor and reactor auxiliary building
2.2.13	Supports	Handling, marking, cutting, fabrication, erection, welding and inspection of pipe supports.
2.2.14	Metal structures	Supply, fabrication, grit blasting, primer application, erection, welding and painting of metal structure
2.2.15	Painting	Supply and application of epoxy paint including grit blasting and primer application.
2.2.16	Insulation	Cold insulation for equipment's and pipelines
2.2.17	Insulation	Supply and application of hot insulation using ceramic blanket (fixed & removable) on piping systems and equipment
2.2.18	Insulation	Shifting, Erection, Assembly, Welding of Incinerator Including Handling, Cutting, Laying Refractory Insulation for Incinerator In Radio Active Waste Processing and Storage Building
2.2.19	Buildings	Buildings and System description

Note: Bidder to refer BOQ for relevant scope of work of this tender

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2.2.1 ERECTION, ALIGNMENT, FIT UP AND WELDING OF STATIC EQUIPMENT IN REACTOR AUXILIARY BUILDING

CONTENTS

Sr No	Description
1	Purpose
2	Scope of work
3	Erection of Static Equipment
3.1	Tolerance & Finishes
3.2	Erection of equipment at Fresh Fuel Storage Building
3.2.1	Swing Gate
3.2.2	Sliding Gate
4	Reports and Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during erection, alignment, welding and inspection of static equipment.

2. Scope of work:

The contractor scope of work involves but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.
- iii. Receipt of material from BHEL/NPCIL store, transportation, storage.
- iv. Receipt of material, handling & preparation of IMIR,
- v. Survey of EPs & marking, orientation and elevations of equipment.
- vi. Handling, shifting, lowering, assembly, erection, alignment, fit up, welding of equipment to the base plate / embedded part equipment as per the requirement given in the working drawing.
- vii. Preparation of as built drawings and reports and submission for acceptance.

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3. Erection of Static Equipment:

- i. Static equipment includes tanks, filters, heat exchangers etc. All these equipments are covered in various buildings covered under this contract at various locations and different elevations. Material of construction of the equipment is carbon steel or stainless steel.
- ii. Check list of all the activities involved in the erection including pre-erection checks shall be made in consent with the Engineer, filling the check list before proceeding or erection after joint survey.
- iii. Survey shall be made for shifting, handling and erection, it shall be ensured that necessary embedded parts are available for handling of equipments for erection. In case there are no embedded parts anchor plates with fasteners shall be erected for handling of equipment in concurrence with BHEL.
- iv. Dismantling and re-assembling the accessories are included in the scope of work if required. In case of any damage or missing occurred in accessories which in custody of contractor, the same shall be arranged by contractor at his own risk and cost.
- v. De-preservation of equipments such as removal of peel able protective coating, removal of grease/oil applied on equipments using high quality Kerosene, other liquid as required.
- vi. Arrangement of temporary fixtures required for shifting and erection of equipment.
- vii. Erection of scaffolding and disassembling after completing the work is included in the scope of work.
- viii. In case of equipment to be fastened to the embedded part / base frame, cleanliness of fasteners shall be checked, and any damage in threads shall be corrected before proceeding.
- ix. Equipments to be erected on the metal platform, in which there may be requirement for providing additional members or modifying the existing members. The same shall be carried out and is included in the scope of work. Measurement and payment for such work will be made in the relevant BOQ item.

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- x. Handling, shifting, positioning of stationary equipment over the foundation, alignment for coordinate and elevation. The same shall be measured and ensured using surveying instruments such as water level, total station, auto level, optical instruments etc.
- xi. Check the nozzle orientation, co-ordinate, horizontality, verticality, elevation for equipment level, tightening of equipment foundation bolts, nuts, washers to required torque using calibrated torque wrench etc.
- xii. Alignment shall be verified for acceptable limit as specified for the particular equipment by the system Engineer.
- xiii. In case the equipment shall be welded to the embedded part, welding shall be carried out by qualified welder as per the approved WPS/PQR. For detailed requirements of welding, technical specification for welding may be referred. Welding shall be performed only after obtaining the acceptance of the alignment.
- xiv. Terminal points / nozzles on the equipments shall be kept closed & equipment must be preserved preventing dust entry till the terminals are released for connected activity.
- xv. All tools and tackles, hydra, truck necessary for safe handling & transportation of the equipment shall be in scope of the contractor. BHEL/NPCIL will not issue crane for handling and erection.
- xvi. Disassembling of all temporary arrangement, cleaning the area, touch up painting and depositing back the packing material to Engineers stores.

3.1 Tolerance & Finishes:

Dimensional tolerance for alignment of static Equipment shall be specified in the drawing or manufacture instruction. Unless otherwise specified, the following tolerances shall be followed during erection.

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a) Installation of Tanks: -

- Verticality deviation of installed tank is not to exceed 2.5 mm per each meter of tank height (from tank centerline)
- Out let pipe (Gravity flow) shall have slope 1:100

b) Installation of Filters: -

- Verticality deviation of filter body shall be maintained at 2 mm per one meter of the filter height.
- Deviation from horizontal drain facilities and from distribution devices shall be 2 mm per 1 meter but not exceed 5 mm for the whole length of the filter (In the direction of the drain)

3.2 Erection of equipment at Fresh Fuel Storage Building (UFC):

General:

- i. UFC building is a rectangular building which is used for housing the fresh fuel arrived at site.
- ii. Fresh fuel storage building houses various equipments such as
 - a. fuel storage racks,
 - b. hatches,
 - c. sliding gate,
 - d. swing gate.
- iii. Scope of work involved in erection of these equipments is similar to the scope of work brought out in the previous clauses of this specification. However there are few special equipment, where the quantum of work involved is huge and different from other normal static equipment.
- iv. Among these equipments, swing gate and rolling gate are the special equipment in which the quantum of work involved is laborious. Detailed scope of work involved is brought out as given in the next clause.

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3.2.1 Swing Gate:

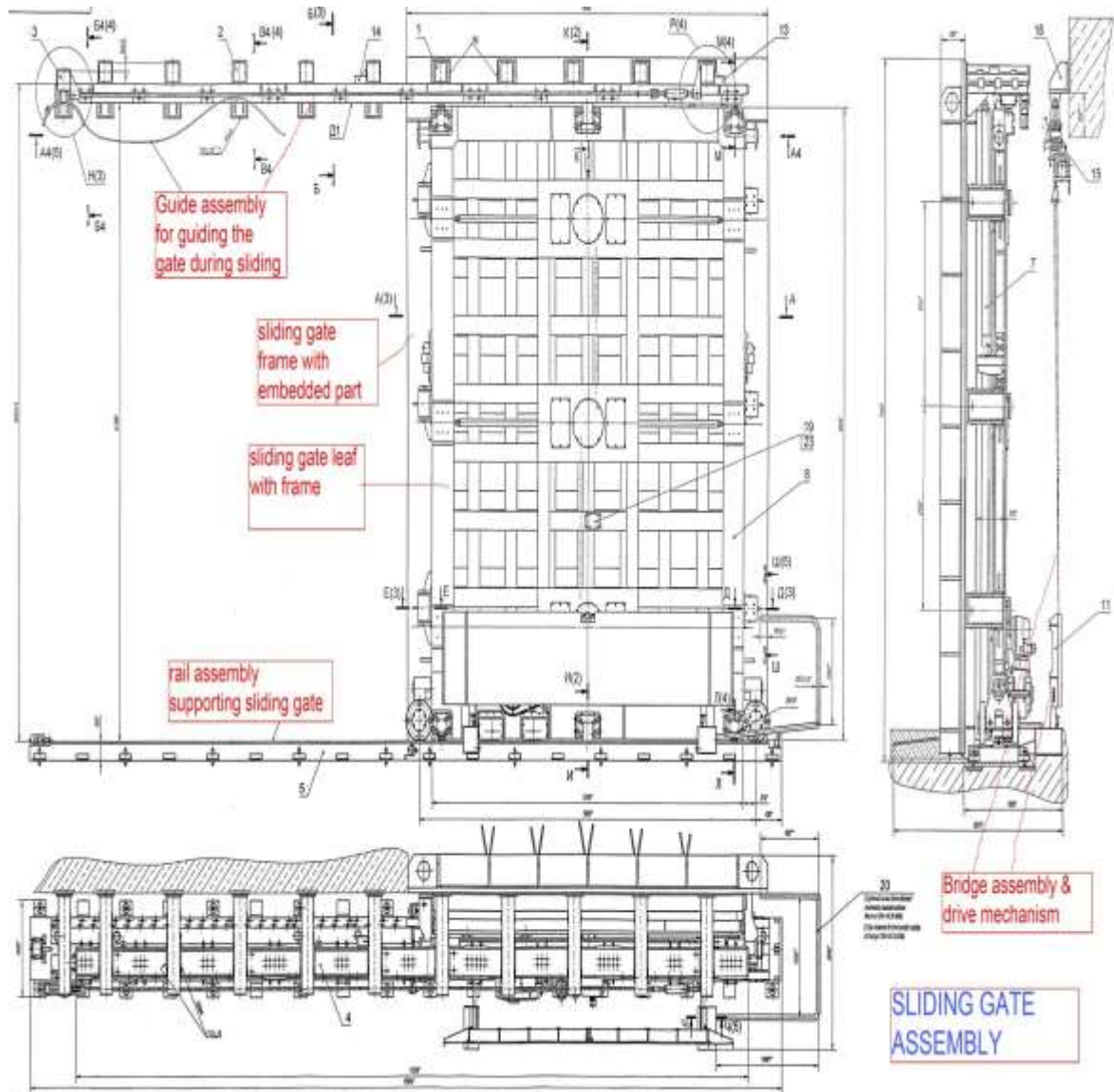
- i. Material movement will be made through double swing gate located at one end of the building.
- ii. Swing gate is provided with two leafs fixed to a frame, and the frame is embedded into the concrete. Due to this the erection of the gate shall be taken up along with the civil construction.
- iii. Proper planning is required for erection of this gate due to involvement of various agencies.
- iv. The leaf of these gates are a hollow box type structure in which concrete has to be filled before the erection. For carrying out concreting there are openings provided over the leaf body to pour the concrete. After completion of the concrete, these holes shall be plugged using the material supplied by welding. Scope includes welding of these plugs also. Concreting will be carried out by NPCIL.
- v. Dry weight (without concrete) of the gate assembly is approx 42MT and after concreting the weight of the gate assembly will be approx 65MT. For measurement and payment erection weight will be considered along with the concrete.
- vi. Typical arrangement of the gate is shown in the sketch below.

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- iv. During normal operation gate will be in closed condition and is locked with the seal with the mating surface provided on the embedded part.
- v. Sliding gate is supported from bottom and guided from top. Rail assembly is provided at the bottom and guide channels are provided at the top. Both bottom rail and the top guides are fixed using embedded parts.
- vi. After erection of the gate assembly rail assembly shall be erected and aligned in position. Before proceeding for rail erection pre survey of the embedded parts shall be taken for horizontality and elevation, so as to maintain the level of the rail assembly. In case any deviation observed in the embedded parts, the same shall be corrected. Scope of work includes such correction of embedded part also.
- vii. Guide channels are supported from the embedded part over the wall. There is possibility for missing the level and the co linearity of the embedded part. In such case there may be requirement for correcting the embedded part by grinding or correcting the guide channel members by modification. Scope of work includes this modification also.
- viii. After successful completion of erection and alignment of the gate, gate shall be checked for smooth movement from one end to other. Further assembly and erection of the drive mechanism bridge assembly shall be carried out.
- ix. Rail assembly shall be erected within 6mm of horizontality for the whole length until unless it is specified in the working drawing. And horizontality of the guide channel shall be erected within 3mm per meter and 6mm for whole length.
- x. Arrangement of necessary tools and tackles, crane(S) required for erection, approx weight of the gate assembly is 60MT.
- xi. Erection of all other accessories of the gate which are supplied with as per working drawings and the manufacturer instructions.

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4. Records and Reports:

Reports for the executed work shall be prepared and submitted for acceptance after completion of work.

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2.2.2 DISMANTLING, SHIFTING, RE-ASSEMBLY, ERECTION, ALIGNEMENT OF PLATE TYPE HEAT EXCHANGER

CONTENTS

SR NO	DESCRIPTION
1	Purpose
2	Scope
3	Information and broad sequence of activities
3.1	General information
3.2	Dismantling, Shifting and Erection:
4	Reports and Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during dis-assembly, shifting, reassembly, erection, alignment of plate type heat exchanger in reactor safety system building.

2. Scope:

The contractor scope work involves but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.
- iii. Receipt of material from BHEL/NPCIL store, transportation, storage.
- iv. Receipt of material, handling & preparation of IMIR ,
- v. Site survey, verification of equipment dimensions with respect to dimensions of erection openings.
- vi. Fabrication of temporary fixtures, dismantling of equipment, locking equipment with temporary fixtures.

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- vii. Lifting, shifting of Equipment & its accessories to erection location, positioning of equipment & reassembling of plate type heat exchangers back to normal, alignment as per drawings and technical specification.
- viii. This work also includes arranging necessary manpower, tools, tackles, fastening of nuts, washers and bolts to required torque using torque wrench, cleaning consumables like acetone etc, preparation of reports and submission for BHEL/NPCIL acceptance.

3. Information and broad sequence of activities:

3.1. General

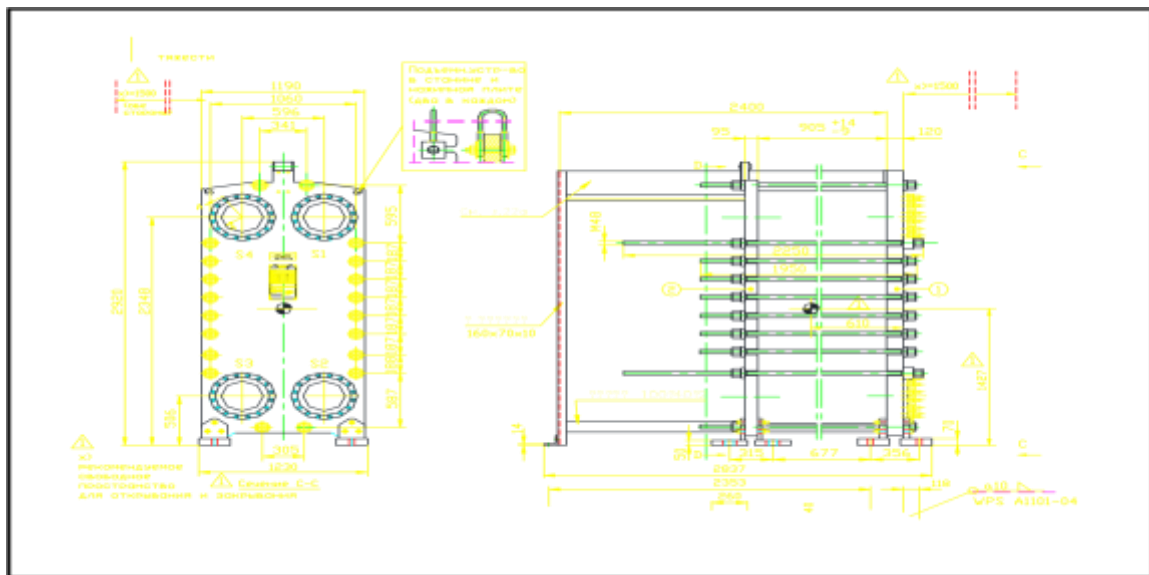
- i. Plate type heat exchangers of 16 nos per Unit belonging to KAA and JNA system are to be erected at -4.250m elevation and -5.050m elevation of UKA (Reactor safety system building).
- ii. Due to access constraints, these heat exchangers are needed to be dismantled in clean room and shifted to the location and re-assembled as per the drawing in the desired orientation on the respective foundation.

3.2. Dismantling, Shifting and Erection:

- i. Make clean room for dismantling heat exchanges.
- ii. The erection opening in UKA building shall be checked for actual size.
- iii. If required temporary studs & nuts of required length to be machined for transportation of plates.
- iv. Dismantling the guide frames, supporting brackets and plate as specified in the manufacturer drawings shall be done.
- v. HX Plate shall be covered with leak tight covers during storage, transportation and till erection at site.
- vi. Dismantled items shall be identified with proper tags.
- vii. Shifting the equipment from store to site and further to location after ensuring clean room condition at site.

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- viii. Ensure required tools, tackles, man power is available. If required trolley shall be arranged / made for shifting dismantled HX items.
- ix. Typical arrangement of the Heat exchanger is as given below.
- x. Fixing the HX supporting brackets in position over the embedded foundation bolts.
- xi. Placing the equipment on the pedestal and fastening of HX with the brackets. During this activity care shall be taken to prevent damage to the threads of the foundation bolt.
- xii. Elevation, orientation of the nozzles shall be checked with respect to the working drawing using survey instruments. Elevation and orientation shall match with the working drawing requirements. If any additional shims to increase the elevation or grinding the embedded part for achieving the required level is included in the scope of work.
- xiii. Fixing the guide frames with HX as per the original arrangement and carrying out alignment.



- xiv. Carryout final torque tightening using proper torque wrench as per the drawing requirement. Care shall be taken so that required torque shall not achieve in a single pass. Torque tightening shall carry out in sequential manner.

4. Reports and Records:

Reports for the executed work shall be prepared and submitted for acceptance after completion of work.

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2.2.3 HANDLING, SHIFTING, ERECTION, ALIGNMENT, INSPECTION OF ROTARY EQUIPMENT

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	General information and scope of work in details
3.1	Erection
3.2	Dismantling and Erection of pumps
4	Reports and Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during handling, transportation, shifting, erection, alignment of rotary equipment in the buildings covered under this contract.

2. Scope:

The contractor scope work involves but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.
- iii. Receipt of material from BHEL/NPCIL store, transportation, handling & preparation of IMIR and de-preservation.
- iv. Pre-erection survey on the foundation, carrying out corrections if any in levelling the foundation.
- v. Shifting of rotary equipments to location, carrying out, lowering, installation & alignment of base frame of equipment.

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- vi. Dismantling of pumps, handling and transportation to location, re-assembly, erection, alignment, inspection of safety system pumps at UKA building as instructed by the engineer.
- vii. Grouting and dry packing of base frame of equipment.

3. General information and scope of work in details.

- i. Rotary equipments includes pumps, compressors, blowers etc, supply of these equipments will be done in assembled form and some over size equipment are supplied in disassembled form. Few equipments supplied in assembled form may be required to be dismantled for shifting to the location.
- ii. All these equipments may require to be erected inside Nuclear Island buildings covered under this contract, at various locations and elevations.
- iii. A tentative list of the equipments is covered in the weight schedule, The list and the weights of the equipments are tentative and subjected to change.

3.1. Erection:

- i. Identification of foundation of respective rotary equipment to be installed.
- ii. Survey and marking of co-ordinates and elevation. Foundation levelling to be checked for correctness with respect to the working drawing requirements, deviation if any shall be rectified in consultation with BHEL Engineer.
- iii. Ensure the availability of the embedded part, availability of pockets, cleanliness of the pockets, and dimensions of pockets as per drawing.
- iv. Fabrication of template for matching the base frame dimension, placing the foundation bolts as per the template, lock the foundation bolts.
- v. Grouting of equipment foundation frame / foundation bolt as per the grouting procedure & curing the valid period for acceptance.
- vi. Positioning of pump /rotary equipment over the foundation and temporarily align & adjust to meet the WD dimensions such as coordinate and elevation.

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- vii. Align pump using water level/ spirit level/ optical instruments etc, checking of nozzle orientation, horizontality, verticality, elevation. Tightening of equipment foundation bolts, nuts, washers to required torque by using torque wrench, arranging shim plates etc.
 - viii. Motor shall be placed over the foundation frame if separate foundation shown in drawings, dimensional adjustments with respect to drawing requirements shall be adjusted temporarily with shim sheets etc
 - ix. Motor shall be aligned with respect to pump shaft dimension both for axial and radial alignment before coupling and checked for free rotation of pump and motor. Axial and radial alignment shall be verified for acceptable limit as specified for the particular equipment by the system Engineer.
 - x. Check list prepared for handling till completion of erection and alignment of rotary equipment shall be filled for acceptance of BHEL/NPCIL engineer, any additional activity arises during the process of equipment is completely in the scope of contractor, shall be carried out without any extra cost.
 - xi. Disassembling of all temporary arrangement made during erection, cleaning the area, touch up painting and depositing back the material to Engineers stores, Returning departmental and other balance materials to Engineers store & submission of material accounting statement for review and acceptance by the BHEL/NPCIL Engineer
- 3.2. Dismantling and Erection of pumps:
- i Due to dimensional constraint, pumps to be erected in UKA of process systems JNA, JMN, JND10, JND50 and KAA located at -7.200m & (-) 4.250 elevation are to be dismantled before shifting to site. The requirement of dismantling may vary to equipment to equipment.
 - ii Study of working drawings / manufacturer drawings, preparation work procedure with detailed sequence of activities, check list of dis-assembly & re assembly based on the manufacturer instruction.
 - iii The pumps mentioned above are related to the safety function systems and very critical component. Manpower engaged (fitter and riggers) in this work shall be

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- qualified & trained and have adequate experience in similar type of work. Man power engaged for this job will be accessed before engaging them in work.
- iv Major components of the pumps are
 - a. Motor Unit.
 - b. Pump Unit.
 - c. Base frame.
 - d. Inter connecting pipelines.
 - e. Gear box assembly
 - v Parts removed shall be properly identified and tagged and preserved.
 - vi Fabrication of jigs and fixtures for transportation of the dismantled parts such as pumps and motor units.
 - vii Establishing the clean room condition with proper area illumination in the work area, covering the floor with proper cover, covering the roof if open to higher elevation etc.
 - viii Handling, shifting the individual dismantled parts to the location.
 - ix Fabrication of template to match with the base frame of the pump units and motor unit.
 - x Align the foundation bolt using the template and fix the foundation bolt with the civil structure.
 - xi Erect the temporary supports for pump / motor unit.
 - xii Release area for making the frame work of concrete for the pedestal of the pump and motor unit.
 - xiii Erect the pump / motor base frame over the temporary supports, fasten with the foundation bolts.
 - xiv Releasing the area for concreting the base frame. Frame work and the concreting is under the scope of the NPCIL.
 - xv Concreting will be carried out for a part height, for sufficient height for foundation bolt embedment.

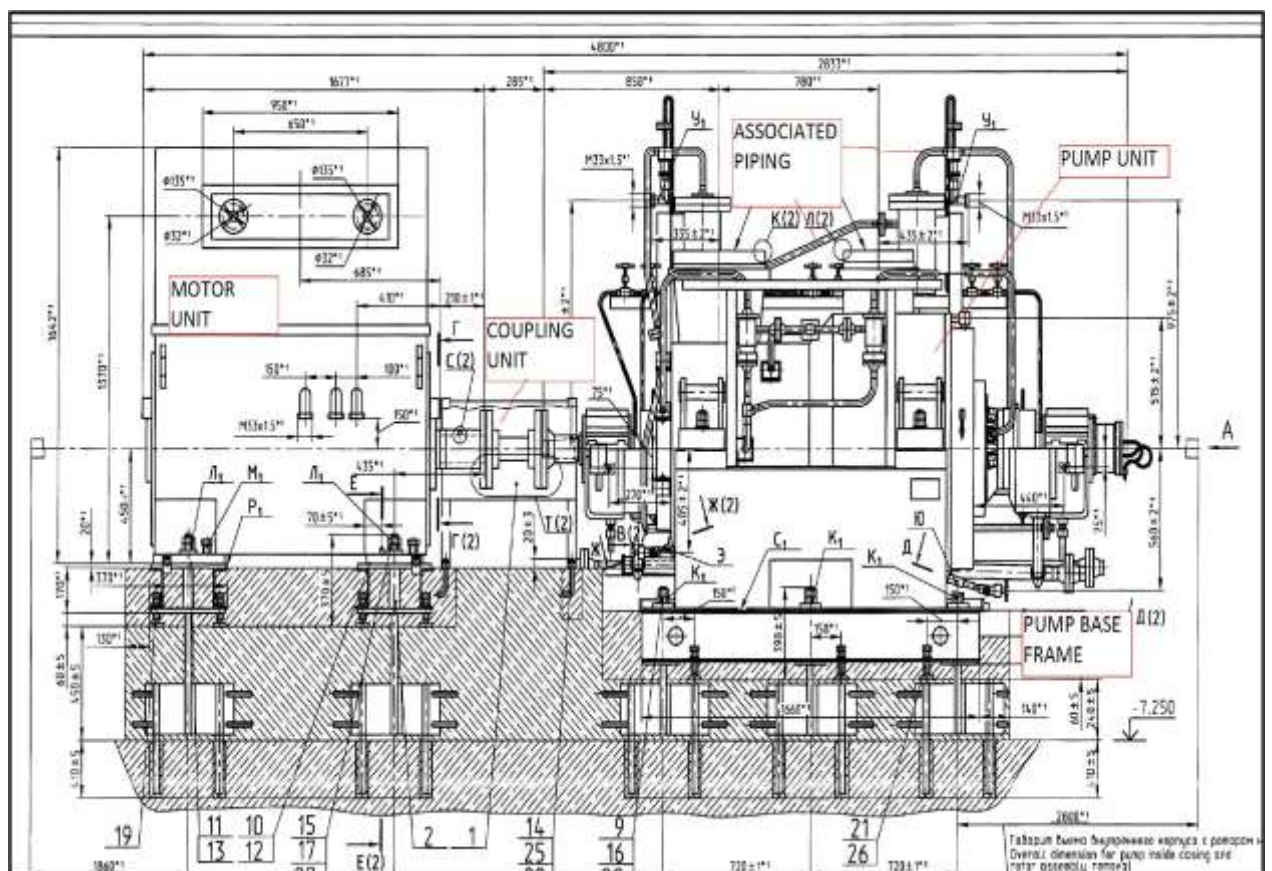
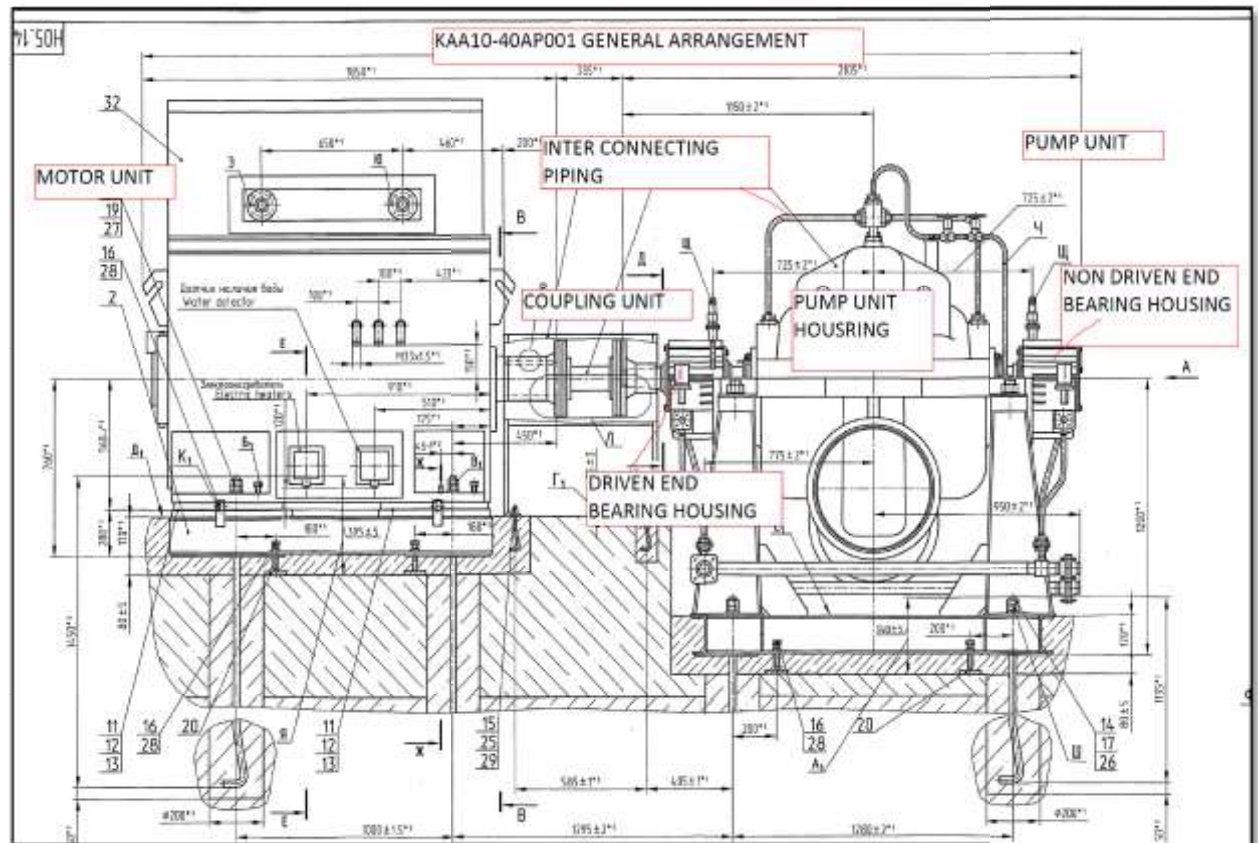
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- xvi Erection of pump unit / motor unit, alignment of axis, nozzle orientation, elevation etc, using master level, auto level, dial gauge etc.
- xvii Erection and assembly of coupling, before that free rotation of the motor shaft and the pump shaft shall be ensured.
- xviii Alignment of the coupling with the help of dial gauge for axial and radial misalignment. Tolerance limit shall be within the limits specified in the working drawings.
- xix Final survey for nozzle orientation, elevation, co-ordinates shall be checked and area shall be released for dry packing.
- xx Scope includes carry out dry packing.
- xxi Preparation of the reports and submission for acceptance.
- xxii Apart from the above activities, KAA pump needs a complete dismantling of the pump unit such as pump housing, impeller, bearing housing on drive end and non-drive end, etc and the same shall be re-assembled in-situ at location.
- xxiii A schematic diagram of the pump assembly is shown with the labelling for a brief idea.
- xxiv On completion of assembly, motor heat exchanger shall be hydro tested for each pump.

4. Reports and Records

Reports such as erection reports, alignment, grouting, disassembling & re-assembling reports, welding, inspection reports etc shall be prepared and submitted as per the QAP and work procedure established.

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2.2.4 HANDLING, ERECTION, WELDING AND INSPECTION OF CARBON STEEL AND STAINLESS-STEEL PIPING

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	General description and detailed scope of work
3.1	Joint Numbering
3.2	Material of construction of piping
3.3	Pipe size
3.4	Erection of small-bore piping
3.5	Erection of big bore piping
3.6	cutting and J-groove machining using beveling machine
3.7	Erection of carbon steel and stainless-steel pipelines
3.7.1	Erection
3.8	Fit up
3.9	Purging
3.10.	Welding
3.11	preparation of CRR
3.12	Hydro-test / Leak test
3.13	Foreign material Exclusion
3.14	Facilities to be provided during welding
5	Reports and Records

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1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during handling, erection & fit up, welding, inspection, preparation CRR (circuit release report) and Hydro / Pneumatic testing of carbon steel and stainless steel piping of various systems covered in the contract.

2. Scope:

The scope of the contractor's work comprises but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.
- iii. Receipt of material from BHEL/NPCIL store, transportation, storage, handling, identification of pipe spools & preparation of IMIR and de-preservation
- iv. Marking of joint numbers in the isometric drawings, identifying the field joints and shop joints.
- v. Pre-fabrication of small-bore pipe spools as per joint marking involving marking, cutting, edge preparation, cleaning, fit up, welding and inspection based on the joint identified.
- vi. Cutting and edge preparation in big bore field joints after removal of excess length.
- vii. Shifting, handling, cleaning, erection of pipe spools to the location, as per the working drawings, alignment, fit up, welding and inspection.
- viii. Erection of supports, valves and other connected elements of process systems as per technical specification and working drawings.
- ix. Preparation of circuit release report (CRR) and submission for acceptance.
- x. Carrying out hydro test / pneumatic testing of the pipelines.
- xi. Post hydro test cleaning including draining and drying of pipelines.
- xii. Preparation of reports and records.

3. General description and detailed scope of work:

- i. The term piping includes pipelines, pipe fittings like bends, elbows, tees, flanges, reducers, on line pipe instruments etc. Piping is broadly classified as follows
 - a) Small bore piping of all sizes below 100 NB (size is less than or equal to 80NB)

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- b) Big bore piping of all sizes 100NB and above. Big bore piping further classified based on the thickness.
- ii. Small bore pipe shall be supplied in standard length as pipe and pipe fittings separately i.e. pipe in standard lengths and the bends, elbows, tees, flanges, reducers etc.
- iii. Big bore pipe shall be supplied in pre-fabricated spools, such as pipe welded with elbow, spool welded with tees etc, and normally supplied with weld edge prepared condition. If any block is supplied without welding edge, edge preparation shall be carried out by the contractor, and payment for such work will be done in the respective BOQ item.
- iv. Piping erection and welding works shall be carried out in compliance with various RF (Russian) standards.
- v. For carrying out piping erection, piping isometric drawings provided shall be followed. In case isometric drawings are not provided for any system, contractor scope includes preparation of isometric drawings based on orthographic (plan & section) drawing provided with in the quoted rates.
- vi. Erection of small bore piping has to be carried out with field routing as per site conditions. Erection of such systems shall be taken up with concurrence of Engineer. Field survey shall be made prior to preparation of isometrics and the same shall be submitted for acceptance of BHEL & NPCIL before start of work.

3.1 Joint Numbering:

- i. Weld joint numbering shall be done using the piping isometrics with proper system, joint numbering shall be decided in consultation with Engineer.
- ii. Numbering system to be followed is elaborated below:

First level.

- a. shall include Shop joints identified as symbol (S),
- b. Field welds identified as symbol (F),
- c. Modification joints if any identified as symbol (M).

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Second level:

- a. Butt weld as C.
- b. Fillet weld as F.
- c. Nozzle weld as N.

Numbering system shall be done as per line number wise of respective systems working drawing.

3.2 Material of construction of piping:

- a. Stainless steel (RF steel grade 08X18H10T & 12X18H10T).
- b. Carbon steel (Various grades of RF material such as Steel 20, Steel 16GS etc)
- c. Cladded piping. (Carbon steel cladded with stainless inside).

3.3 Pipe Size:

The pipe dimension shall be as per Russian standards. The sizes will not match with Indian and American standard. Hence, the Nominal pipe sizes with matching outer diameter and welding unit in INCH DIA considered for measurement are given below in table-1

Table-1			
PIPE NOMINAL BORE WITH INCH DIA			
SR NO	PIPE NOMINAL BORE	OUTER DIA	INCH DIA
1	10	14	0.5
2	15	18	
3	20	25, 28	1
4	25	32	
5	32	38	1.5
6	40	42	

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7	50	57	2
8	65	76	2.5
9	80	89	3
10	100	108	4
11	125	133	5
12	150	159	6
13	200	220	8
14	250	273	10
15	300	325	12
16	350	370	14
17	400	426	16
18	500	530	20
19	600	630	24
20	800	840	32
20	1000	1020	40

3.4 Erection of small bore pipeline:

- i. The pipe line and pipe fitting are supplied separately. Pipe fitting and valves will be supplied in edge prepared condition whereas pipe will be supplied in plain end. It is the responsibility of contractor to review the field routing and shall carryout cutting, edge preparation and welding.
- ii. In general small bore piping work shall start only after big bore piping are erected except certain system where it is unavoidable.
- iii. Small bore pipe edge also may be done using bevelling machine as specified in working drawings.
- iv. Support shall be erected after finalization of pipeline routing.

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- v. Care shall be taken to prevent wastage of pipe as per approved drawings & wastage of pipe fitting is strictly prohibited.

3.5 Erection of Big bore piping:

- i. Big bore pipe shall be supplied in pre-fabricated spools and edge prepared condition along with edge prepared pipe fitting and valves.
- ii. The pipe spools issued will have field cutting margin at direction change / hook up joints. Contractor shall cut the excess length as per field measurement with bevel cutting machine.

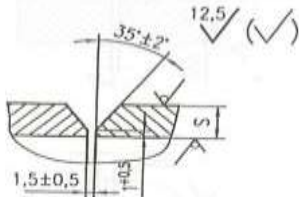
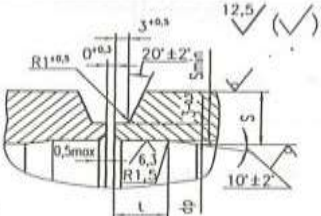
3.6 Cutting and J-Groove machining using Bevelling machine pipeline:

- i. Most of the piping covered in this contract shall have J-groove edge and few cases V-groove.
- ii. In case any pipe spool which are supplied without edge preparation, weld edge for such spools shall be prepared as per the requirements given in the working drawing / applicable standards / technical specification.
- iii. Some of the hook up joints in the big bore pipe spools weld edge preparation is needed to be carried out in-situ to suit the site condition.
- iv. Pipe fittings such as throttling orifice, flow restricting orifice and other components in big bore will be installed after successful flushing operation. After flushing these elements are to be installed by cutting of the main line and edge preparation at site.
- v. Cutting and edge preparation of such big bore pipe spools shall be carried out using bevelling machine only. It is not permitted to carry out cutting, edge preparation of big bore pipe spools using normal grinding machine.
- vi. Pipe bevelling machine mobilized by the contractor shall be capable of cutting and edge preparation for the diameters range of 100NB to 600NB.
- vii. Maximum thickness of the pipelines varies up to 20mm.
- viii. Contractor shall provide different size of bevelling machines, necessary machining tools, tackles and other accessories for bevelling. Also necessary cooling, cleaning

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consumables such as cooling oils, water, air supply in case of pneumatic operated bevelling machines shall be provided with manpower.

- ix. Arrangement of template for guiding the tool to get the required edge profile shall be provided.
- x. The contractor shall conduct demo/mock up to qualify bevelling machine, arrangement required and qualify operator including template before taking up the actual work.
- xi. Providing & erection of scaffolding for safe reach and carrying out bevelling operation.
- xii. Setting of bevelling machine on pipe is a very skilled work, any deviation in setting the machine will lead to damage the parallelity of the pipe weld edge. Hence only qualified and experienced operator shall be engaged for operating the machine.
- xiii. In case of connection welding with equipment or other edge prepared components, the contractor shall verify the ID of the existing pipe before taking up edge preparation. In some cases ID pipe shall be machined / bored to required length in order to match the diameter as mentioned in the standard.
- xiv. Machined profile shall be checked for correctness using template.
- xv. Cleaning the area after machining, shifting all the scrap outside the working area.
- xvi. Typical profile of the V-groove and J-groove are as given below.

Joint Number	Weld Joint Designation	Abutting Tubes or Fittings		Groove of Pipeline Fittings
		External Diameter of Pipes, mm	Wall Thickness of Pipes, mm	
Joints of Fittings of Steels of Grade 08X18H10T and 12X18H1				
01	1-23 (C-23)	14 through 57	2 through 3	
02	1-25-1 (C-42)	76 through 325	4,5 through 12	

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3.7. Erection of Carbon steel and Stainless-steel pipelines:

- i Handling, transportation of pipe material from the BHEL/NPCIL stores to the contractor store for segregation, identification, comparing with the bill of material mentioned in the working drawing, check for completeness of the piping material supplied.
- ii Avoid direct contact between stainless steel and carbon steel material.
- iii Separate tools shall be identified with colour coding for working with stainless steel pipe components.
- iv Prior to shifting and erection, pipelines shall be mechanically cleaned thoroughly, from outside and inside, using wire brush & cotton waste. Pipe shall be free from any kind of foreign material and preservatives.
- v Mechanically cleaned pipelines shall be cleaned using oil free compressed air from inside.
- vi Cleaned pipe end shall be covered with plastic end caps at shop as well as at site.
- vii In case of carbon steel pipe lines, pipes shall be shifted only after grit blasting, primer application and final paint leaving the weld joint area for welding.
- viii Painting of weld joint area shall be done at the site after completion all NDEs stipulated.

3.7.1. Erection:

- i. Erection shall be taken up system wise to meet the target agreed and specified by BHEL.
- ii. Prior to erection of pipelines, reference co-ordinate shall be transferred to the working area / nearby structure so that once pipe is erected correctness can be checked with respect to the reference co-ordinate.
- iii. In general piping erection shall start from equipment nozzle / hermetic penetration to prevent transfer loading to equipment.
- iv. As most of the piping are stainless steel sequence of pipe welding shall be done considering purging weld joint.
- v. Offset of pipeline at equipment / flanges after welding is not permitted.

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- vi. Unless otherwise it is specified in the drawing all the drain lines shall be routed up to the nearest drains collection point. Routing of such line shall be done with prior approval from the Engineer.
- vii. Temporary supports erected during erection of pipelines shall be cut and removed after erection of permanent supports. Material required for such temporary supports shall be arranged by contractor himself.

3.8. Fit up

- i. Fit up shall be carried out as per the specification, working drawings and applicable codes and standards using standard pipe clamps/fixtures. No direct welding of the weld cleats is permitted for making fit up.
- ii. Root gap shall be maintained as per the applicable standards and working drawings.
- iii. No tack welding is permitted on the weld edge during fit up stage.
- iv. Pipeline ovality shall be checked before proceeding for fit up. Mismatch is not allowed during fit-up. If any such mismatch it shall be within the permissible values.
- v. Special clamps, jigs or fixtures required for carrying out fit up of piping shall be arranged by contractor.
- vi. Application of mechanical loads for alignment and Fit up of pipelines is not permitted. Pipelines shall be tension free while carrying out fit up and alignment.
- vii. Weld edge shall be properly cleaned using acetone.

3.9. Purging:

- i. Stainless steel piping needs argon purging during welding irrespective type of welding such as GTAW.
- ii. Nozzle purging with argon needed for both carbon steel and stainless-steel welding while using GTAW process.
- iii. Purity of argon shall not be less than 99.98%.

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- iv. Purging dams shall be used for purging during welding of stainless steel pipelines. Purging dams used shall be of removable type, proper purging dam register shall be maintained for ensuring the removal for dam.
- v. Using of masking tape for fixing of soluble purging dam is not permitted. Only soluble gum shall be used for fixing the purging dam or purging tube etc.
- vi. In case of unavoidable situation, hook-up joints and closing joints, soluble type purging dams may be used.
- vii. Inflatable type purging dams may be used for purging big bore pipelines. Implementing of such dams will reduce the usage of masking tape, rubber dams which are vulnerable for damage.
- viii. During course of time after erection of few piping systems, carrying out the Argon cylinders to the location will be difficult, in view of this contractor shall arrange small size cylinders which can be carried to site easily.

3.10. Welding:

- i. All welding shall be carried out as per the approved welding procedure and qualified welders. Most of the piping welding shall be done using Russian material including welding consumable (electrode / filler wire), hence contractor shall provide adequate training to welder before permitting for qualification.
- ii. Welding shall be carried out only by qualified welder, tack welding of fit up shall also be done by using qualified welder.
- iii. Welding covered in this contract shall be carried out using 3 phase welding generator only. No rectifier type single phase welding machine shall be employed for welding operation. Approval from BHEL shall be obtained for use of rectifier.
- iv. All qualified Welders shall be provided with the proper apron for easy identification & shall carry qualification card always.
- v. No weld joint shall not be left with root pass, immediately after root pass subsequent pass shall be completed.

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- vi. Root weld inspection windows (at least two numbers) shall be left for checking the root welding. The windows shall be closed only after inspection and clearance of weld root.
- vii. During stainless steel welding operation HF unit is mandatory for GTAW process. No SS welding with GTAW is permitted without HF unit.
- viii. Welding electrodes shall be always stored in mother oven and intermediate oven and transported in the portable oven at site.
- ix. Welding filler wire shall be brought in closed container.
- x. Proper identification technique (colour coding) shall be employed for easy identification of filler wire for carbon steel, stainless steel and dissimilar filler wire.
- xi. Welding stubs shall be collected and stored and shall be taken out from site on day to day basis. Engineer may verify at contractor shop.
- xii. On completion of welding, weld joint information along with the welder number shall be engraved near the weld joint area.
- xiii. Purging arrangements made shall be removed and pipe shall be thoroughly checked for any left out foreign material inside the pipe.
- xiv. Open pipe ends after welding shall be closed immediately and after day to day activities.

3.11. Preparation of CRR: Following activities are involved.

- i. Study of flow sheets, identification of hydro test loops, marking and submission for acceptance to BHEL/NPCIL. (Note: One system may have more than one working document, one working document may have many numbers of loops, each loop shall have separate CRR).
- ii. Identified loops shall be marked in the flow sheet with test pressure, test medium, leak search pressure and test duration etc.
- iii. Preparation of as-built drawing of testing loop (consisting many lines), verification of pipe line at field for weld joint, support & valve location, clearances, removal of temporary support & attachments and making ready for testing.

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- iv. Compiling all the reports, loop wise such as liner erection report, weld joint history sheet, support erection report, valve erection reports, list of terminal points, list of exemption if any etc.
- v. Submitting the CRR (compiled reports, hydro test circuit) to BHEL/NPCIL (Various departments such as User section, Field engineer, QA section etc) for acceptance.
- vi. Even though no physical work is involved in CRR preparation, this is a very important activity and CRR is a pre-requisite for hydro test of the loop

3.12. Hydro-test / Leak test:

- i. Hydro test shall be carried out only after obtaining the approval of CRR.
- ii. Test may be carried out for single loop or clubbing of loops of same pressure requirement.
- iii. DM water required for carrying out hydro test shall be provided by NPCIL.
- iv. Hydro test shall be carried out as per the approved hydro test procedure.
- v. Before carrying out hydro test proper vent and drain points shall be identified. If required new temporary vent shall be made with the approval of engineer and to be welded after hydro test.
- vi. Vent shall be kept open during filling and draining of the circuit to vent the air out from the circuit.
- vii. Minimum two pressure gauges and one pressure relief valve (PRV) shall be used for hydro test.
- viii. Pressure gauge shall be calibrated before test is commenced. Validity period of the pressure gauge calibration will vary and shall be as per the codal requirements. PRV shall be calibrated for 10% more than hydro test pressure.
- ix. Medium of testing shall be as per the working drawings, in case of pneumatic testing medium of testing shall be followed as per the working drawings.
- x. Gross leak test using pneumatic testing at lower pressure shall be done to ensure the tightness of system and also to check the healthiness of various components and

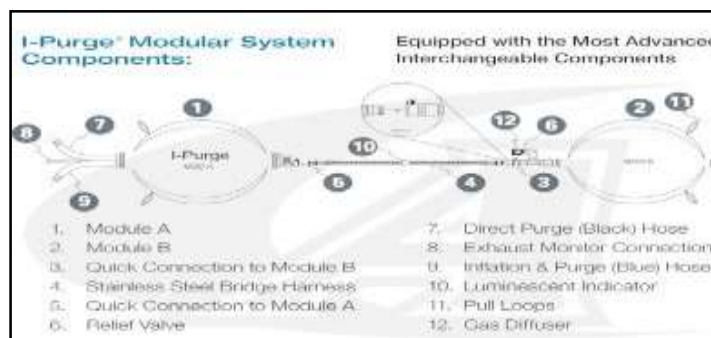
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pressure boundary. In general, large loops shall be invariably tested at lower pressure using pneumatic test before filling water.

- xi. Pressurization shall be carried out using electric operated pumps/ manual operated pumps / air compressor /nitrogen cylinder etc.
- xii. Hydro test pumps shall have Maximum pressure: 25MPa, 380V, pressure gauge mount with spare connection, SRV, NRV etc. Sufficient length of hose also shall be arranged.
- xiii. Hose arrangement shall be made to collect the water from vent line to nearest drainage. Spillage of water is not permitted. Draining shall be done at lowest point and water shall be drained to nearest sump /pit.

3.13. Foreign Materials Exclusion (FME):

- i. During execution of piping, equipment erection, valves, fittings, orifice etc utmost care shall be taken to prevent foreign material inside these items.
- ii. Contractor shall train all workers to prevent stacking / placing of hand tools, welding consumables, PPEs inside pipeline during erection and welding.
- iii. Any such items found during further course of inspection, it is duty and responsibility of the contractor to remove such material from the location by any possible method. Efforts required for such works will not attract any kind of payment.
- iv. Dam register shall be maintained for all the dams such soluble dams, rubber dams etc. It shall be ensured whether all the dams are properly removed.
- v. Also latest tools such as inflatable dams for pipe welding shall be considered in place of conventional dams. Typical sketch of inflatable dams are as given below.



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- vi. Contractor shall arrange boroscope of minimum 30m length for carrying out inspection inside pipe on regular intervals during execution within the quoted rate.
- vii. The video boroscope shall be mandatorily used Where ever pipe changes its direction, whenever valve erection is being done, whenever piping is terminating with equipment.
- viii. Following is the typical sketch of boroscope.



- ix. Following are the specifications boroscope.
 - a) Flexible, fiberglass core, 30m waterproof camera probe (spool assembly).
 - b) 25mm camera head (60° FOV, long depth of field) with built-in bright 12 LEDs for illuminating the problem areas
 - c) Wireless handset/transmitter with brightness and power controls.
 - d) Color LCD TFT with minimum 640 x 480 VGA pixel resolutions.
 - e) Rugged oil/chemical resistant and water/drop proof housing (IP67).
 - f) SD memory card included to store >15,000 images.
 - g) Video recording with Voice annotation.

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- h) AV output for viewing images and video directly on a monitor.
- i) Video and images can be transferred to a PC via the SD card (included) or USB output
- j) Complete with Video Scope, wireless handset, 25mm camera probe, SD card, 3.7V rechargeable battery, patch cable, AC adapter (110-240V, four plugs), USB and AV cables, and hard carrying case

3.14. Facility to be provided during welding:

- i. Hand lamps used for inspection shall be powered from 24 V DC power supply.
- ii. Welder working in confined area shall be provided specially designed breather apparatus with filter.
- iii. In general fume extractor shall be provided with sufficient number to facilitate smoke free atmosphere.
- iv. All welders shall be provided with heat resistant silicon fabric to prevent fall of hot molten metal during welding.

4. Reports and Records:

- i. Necessary reports such as erection reports, welding reports, inspection reports, line history sheets, line erection reports, circuit release reports etc shall be maintained as per the approved quality plan and the work procedure.

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2.2.5 WELDING FOR NIEP ERECTION PACKAGE WORKS

CONTENTS

S.No	Description
1.	Scope
2.	Welding processes
3.	Welding procedure
4.	Qualification and performance records of welders
5.	General welding requirement
6.	Welding of clad materials
7.	Joint preparation
8.	Fit up
9.	Weld profile
10.	Welding of structural attachments, hangers and supports
11.	Tack welds
12.	Repairs
13.	Seal welds
14.	Shielding and backing gases
15.	Heat treatment of welds
16.	Welding of GI pipes
17.	Examination methods and requirements
18.	References

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1. SCOPE

This specification describes the requirements concerning welding of piping and equipments for the Kudankulam Nuclear Power Plant. It is applicable to shop welding and field erection welding for piping. This specification provides general requirement as guidelines, however the work will be carried based on detail requirement specified in the working documentation, manufacturer's documents. In case of any conflict in the requirement specified in the specification, the requirement specified in the working document and Russian standards will govern.

2. WELDING PROCESSES:

2.1 Following welding methods may be used for making welded joints in equipments and pipelines.

- Automatic submerged arc welding (SAW)
- Manual arc welding with covered electrodes (SMAW)
- Automatic, semiautomatic and manual arc welding (GTAW, GMAW, MIG)

2.2 Two or more welding methods of those specified above can be used for making the welded joint (combination welding)

3. WELDING PROCEDURE

3.1 A Welding Procedure Specification (WPS) (Welding Technology) is a written document that provides direction to the welder for making production welds.

The procedure should specify following minimum variables

- Welding methods
- Qualification of welders
- Types of welded joints to be performed
- Type and polarity of welding current
- Welding equipment to be used

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- Combination of grades of basic and welding materials
- Necessity, methods and conditions of preliminary and accompanying heat up in welding
- Space positions of welding
- Range of filler materials
- Procedure of putting in runs and layers of seam and beads (whenever required)
- Types of thermal treatment of welded joints and built up of metal parts
- Conditions of welded joints from completion of welding till the start of thermal treatment

The WPS shall make reference to the supporting Procedure Qualification Record(s) (PQR). The contractor may include any other information in the WPS that may be helpful in making a weldment. Enclosed sample form-A has been provided as guide for the WPS

- 3.2 Procedure Qualification Record (PQR)/ (Welding Technology Certificate) Each manufacturer or contractor shall be required to prepare a procedure qualification record, which is defined as follows:

A PQR is a record of the welding data used to weld a test coupon. The PQR is a record of variables recorded during welding of the test coupons. It also contains the test results of the tested specimens. Recorded variables normally fall within a small range of the actual variables that will be used in production welding.

Enclosed form-B has been provided as guide for the PQR. Also the type of tests, number of tests, and test results shall be listed in the PQR.

For welding technology certification (PQR) requirements of destructive and non-destructive testing as specified in the working documents is the basis.

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Order of removal of specimen is also mentioned. The length of welded joint (Test Coupon) shall be sufficient to take required number of specimens.

The weld joint (test coupon) can be made in down hand position. When outside diameter of the production joint exceeds 500 mm, it is permitted to make test on plate.

3.3 Methods of determining dimensions of specimens, requirements and conditions for execution of test and calculation of results for Static Tensile Test (refer GOST 1497-73) and for Impact Bending Test (refer GOST 9454-78) and GOST 6996-66 shall be used if specified unless otherwise specified in the documents.

3.3.1 Quantity of specimens intended for mechanical tests shall not be less than two for tests at each temperature.

3.3.2 If results of mechanical tests of any type are unsatisfactory, then retests shall be allowed with specimens of doubled number. Results of retests shall be final.

3.3.3 When there are special requirements of the design documentation, mechanical properties of cladding material of austenitic steel shall be defined where they are intended for a structure which is after welding will be heat treated.

3.4 Metallographic Analysis

3.4.1 The quality of welded joints subjected to Metallographic analysis should be considered satisfactory if the following conditions are concurrently satisfied;

- The macrosection has no cracks and incomplete penetrations
- The maximum dimensions of any inclusions and clusters do not exceed the maximum permissible size specified PNAEG-7-10-89 (refer Table-19)

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- The distance between any two inclusions and clusters is at least three times the maximum size of any one of two considered inclusions of clusters.

The sum of the maximum sizes of inclusions and clusters discovered on the macrosection does not exceed three times the largest permissible size of an individual inclusion specified in PNAEG-7-10-89 (table 19- Norms of Individual Inclusions and Clusters Permissible in Welded joints during Metallographic analysis) for the corresponding rated thickness of the welded parts, the inclusions and clusters with the maximum size up to 0.2 mm should be disregarded

3.5 Intercrystalline Corrosion Test

Corrosion-resistant steels and alloys including two-layer ones, welded joints, deposited metal and weld metal made using austenitic welding materials shall be subject to intercrystalline corrosion test.

Intercrystalline corrosion test is performed by “AM” or “AMU” methods (refer GOST 6032-84)

3.5.1 AM Method

Principal of the method: Steel samples should be kept in boiling aqueous solution of copper sulphate and sulphuric acid in presence of metal copper

3.5.1.1 Solution for test: Copper Sulphate (130.0 ± 0.1) g in weight should be added to water of volume (1000 ± 3) cm³ and then sulphuric acid of (120 ± 3) cm³ volume is added by small portions.

3.5.1.2 Holding in the boiling solution shall last for (24.00 ± 0.25) h. In case of forced termination of test, the specimens are not withdrawn out of the solution. Duration of test is calculated as total number of boiling test hours.

3.5.1.3 After holding in solution, the specimens shall be washed and dried.

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- 3.5.1.4 To detect intercrystalline corrosion the specimens shall be bent for an angle of $(90 \pm 3)^\circ$ upon completion of holding.
- 3.5.1.5 Examination of the bent specimens is performed by means of magnifier with a magnification of 8-12 power.
- 3.5.1.6 When the test specimens are broken at bending or the cracks are detected after bending except for the longitudinal ones and the cracks directly on the edges, and also if on the specimens with thickness less than 0.1 mm the bend does not reveal intercrystalline corrosion or specimen bending is not possible (because of its dimensions), then resistance to intercrystalline corrosion of the specimens having passed the tests in solution shall be evaluated by metallographic method.
- 3.5.1.7 Presence and depth of intercrystalline corrosion using the metallographic method are defined on the etched metallographic specimens with magnification of at least 200 power. Etching is carried out only till the grain boundaries are slightly revealed. The metallographic specimen is examined from a side of the controlled surface to define maximum depth of failure revealed in six fields of vision. These fields of vision shall include the sections with the highest depth of intercrystalline corrosion.
- 3.5.1.8 A sign of resistance to intercrystalline corrosion during metallographic examination is considered to be failure of the grain boundaries for the maximum depth of not more than 30 μm unless otherwise specified in the standards for metal products; in the metal product specimens with thickness less than 1.5 mm – for the depth of not more than 10 μm .

3.5.2 AMU Method

This method consists in holding the steel specimens in the boiling aqueous solution of copper sulphate and sulphuric acid of increased concentration as

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compared to the “AM” method in presence of metallic copper. The method is an accelerated one and is applied for the same steels as the “AM” method.

3.5.2.1 Solution for testing: In water of (1000 ± 3) cm³ volume one shall dissolve copper sulphate of (50.0 ± 0.1) g and then sulphuric acid of (250 ± 3) cm³ shall be added by large portions.

3.5.2.2 Holding in solution lasts for (8.00 ± 0.25) h.

3.5.2.3 Intercrystalline corrosion is detected in the same way as specified above.

3.6 Determination of the Content of ferrite phase in built up metal

The content of ferritic phase in the built-up metal should be within 2 to 8% in the welded joints of structures that operate at temperatures up to 350 deg. C and 2 to 5% for structures operating at temperatures above 350 deg. C, but in all cases, it should not exceed the upper limit established in the standards or specifications covering the corresponding filler.

4 REQUIREMENT ON QUALIFICATION AND PERFORMANCE RECORDS OF WELDERS

4.1 The welders are certified by testing their theoretical knowledge and practical skills. The theoretical knowledge of welder shall be assessed by the certification committee. The practical skills of the welders are checked by making test weld joints. Welders who have successfully meet the above-mentioned requirements are granted permit certificates allowing them to perform corresponding welding operations by the committee.

4.2 The welding operations are subdivided into the following types used in certification testing of the welders

- Welded joints making (including groove facing for welding i.e. welding/buttering of groove joint)
- Welding of pipes into pipe grids

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- Corrosion-preventive facing (cladding)
- 4.3 When testing the practical skills of the welder, he has to make test welded joints with following instructions
- The test length of a seam should not be less than 200 mm with manual and semiautomatic welding on plates and not less than 400 mm with automatic welding
 - The number of test welded joints in welding pipes is to be established according to the nominal outside diameter of the pipes as given below
 1. Diameter below 25 mm – minimum 5 test joints
 2. Diameter 25 to 100 mm – minimum 2 test joints
 3. Diameter above 100 mm – minimum 1 test joint.
 - The number of pipes in welding into pipe grids (Tube to Tube sheet weld) should not be less than 7 with one of the pipes in the central position with reference to the rest of them.
 - The gauge of plates in making test specimens for cladding of the corrosion preventive material should not be less than 40 mm.
- 4.4 Welded joints made by welders shall be tested using the following methods
- Visual
 - Measuring
 - Radiographic (except for test welded joints of pipe grids)
 - Ultrasonic (except for test welded joints of parts with a nominal wall thickness up to 5.5 mm)
 - Magnetic powder or capillary (except for test welded joints of the III category)
- 4.5 In performing certification testing, the following characteristics of the welded joints should be provided

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- Category of welding (the details of welding categories are given in section 5.16)
- Group of main welding materials. Certification testing should be carried out separately for each of the group of materials mentioned in following table.

Group of main welding materials is given in following table

GROUP NO	TYPES AND CHARACTERISTICS OF MATERIALS
1	Pearlitic steel with limited yield at normal temperatures up to 315 MPa requiring no heating up in the welding
2	Pearlitic steel with limited yield at normal temperatures up to 315 MPa requiring heating up in the welding
3	Pearlitic steel with limited yield at normal temperatures above 315 MPa
4	High alloy chrome martensitic and martensitic-ferritic steel
5	High alloy chrome ferritic steels
6	High alloy corrosion resistant austenitic steels
7	Nickel based and ferronickel base alloys
8	Aluminium and its alloys
9	Copper and copper-based alloys
10	Zirconium and its alloys
11	Titanium and its alloys

- Type and dimensions of welding parts (refer PNAE-G-7-009-89. appendix-3, Basic Types of welded Joints)
- Welding positions

There are 14 welding positions as follows:

- Bottom (down hand) position
- Horizontal position

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- Vertical position upward
- Ceiling (unsupported) overhead position
- Bottom (down hand) position with horizontal axis of pipes to be welded with turning
- Horizontal position with vertical axis of pipes to be welded
- Changing position with horizontal axis of pipes to be welded without turning
- Gravity position
- Vertical position upward
- Ceiling (unsupported) position
- Bottom (down hand) position with horizontal axis of a pipe to be welded with turning
- Bottom (down hand) position with vertical axis of a pipe to be welded
- Changing position with horizontal axis of a pipe to be welded without turning

4.6 Certification testing should be conducted separately for each category of the welded joints (I, II, III) in accordance with the Russian specifications.

4.7 Certification testing in pipe welding is to be conducted separately for the following pipe diameters: below 25 mm, above 25 and up to 100 mm, above 100 mm to 500 mm. Parts above 500 mm are equated to plates.

4.8 Welder certification testing could be divided into primary, additional, periodic and special. The primary certification is meant for welder who have not been allowed before to conduct welding or facing operations on the equipment or pipelines. The additional certification is meant for welder who have passed the primary certification but who need a permit to conduct welding operation not shown in their certificates. It is also meant for welders who have more than 6 months break in their experience in conducting welding operations. The periodic certification is meant for welder in order to extend the validity term of their certificates and to make out the permits to work. It is to be carried out every two years. The special certification is meant for welders who have been

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temporarily debarred from work for violations in welding operation technology or for recurring bad quality of welding operations conducted by the welders.

4.9 Permit certificates to make welded joints of the category I cover permits to make welded joints of the II and III categories as well. (Contractor may choose to qualify welder in higher category).

4.10 The welded joints and surface parts should be adequately marked, thus making it possible to identify the name of the welder responsible for performing the welding operation. The stamps of all welders participating in the welding operation should be applied on each welded joint. In this case, in front of the stamp of welder responsible for buttering operation, additional stamp "B" should be applied, whereas in the front of the stamp of the welder responsible for the root weld, additional stamp "R" should be applied. In case welded joint is made all over the section by the same welder, the above specified additional stamps need not be applied.

5 GENERAL WELDING REQUIREMENT

5.1 Before the beginning of the welding, following points should be checked:

- Availability of a procedure and qualification record of the operator to perform the work in hand
- Availability of markings and/or of record of fit up clearance of the weld confirming the compliance of the assembly with the established requirements
- Cleanliness (absence of visible dirt, dust, rust, oil, etc) of edges and adjoining surfaces to be welded and of the sections of base metal subject to non-destructive inspection
- Grades and nomenclature of welding materials used
- Baking of coated electrodes and fluxes or correspondence of moisture content of fluxes and electrode coating to the established requirements
- Availability of the shielding gas supply

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- Temperature of preheating
- Sequence of application of beads and layers

5.2 Storage of Electrodes

After baking, the covered electrodes and fluxes should be stored in closed bags made of waterproof cloth (polyethylene film) or in closed containers with a rubber sealed cover or in a drying chambers at a temperature of $80 \pm 20^{\circ}\text{C}$ or in a stored room at room temperature and relative humidity of 50% nominal.

In storage after baking in store rooms as specified in above para, the covered electrodes and fluxes can be used without moisture content check and repeated baking within terms specified in the working document and terms being specified shall not exceed:

- 5 days for electrodes with basic coating intended for pearlitic and high chromium steels
- 15 days for remaining electrodes
- 3 days for the fluxes, (Russian grades)
- 15 days for fluxes of other grades

If the storage conditions specified in above section 5.2 is not met, then electrodes and fluxes should be checked for moisture content or should be baked prior to using it.

5.3 The root section of the seam of welded joints of I category of parts made from iron nickel alloys at a rated wall thickness at the point of welding exceeding 6 mm and from steel at a rated wall thickness at the points of welding exceeding 20 mm should be subjected to radiographic control.

5.4 In the butt weld connections of components with different thickness, gradient junction from big to the small section shall be ensured by means of appropriate one side / two sides mechanical treatment of the end of

TECHNICAL CONDITIONS OF CONTRACT (TCC)

element having more thickness. Inclination angle of transitions surfaces shall not exceed 15°

- 5.5 In case of difference of wall thickness less than 30% from the wall thickness of the thinner element but no more than 5 mm, it is allowed to make the specified gradient junction from the side of edge opening due to inclined location of the weld surface.
- 5.6 Distance from the transverse weld joint of the pipeline to the edge of the support or suspension bracket shall be selected on the assumption of possible examination, inspection and heat treatment
- 5.7 All pipelines welded connections (including welds of the components to be welded) shall be located in the way to ensure possibility to inspect them by methods stipulated by standards for the goods.
- 5.8 Angle butt welds for which tightness requirement are specified in the drawing should be made in at least two layers.
- 5.9 With two side welding, partial or complete removal of the root portion of the made weld is allowed before starting welding on the other side.
- 5.10 In carry out the multiple passes of welded joints of the parts made of austenitic steels and iron-nickel alloys, welding should be stopped after each pass until metal cools down in the zone of welding restoration to a temperature not exceeding 100°C
- 5.11 The root portion of welded, joints of parts made of steels grade 08x18Hx12T and also pipe made of carbon steels with a rated thickness of wall exceeding 12 mm are recommended to be welded with the use of filler wire
- 5.12 Manual arc welding with covered electrodes and rods made of austenitic steels should be made of narrow passes with width not exceeding three times the diameters of used electrode

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- 5.13 When welding butt joints, full penetration should be ensured (welded joints with backing plates remained including the ring spacers are considered to be joints with full penetration.
- 5.14 It is not allowed to manufacture welded pipes and shells with the nominal outer diameter of up to 920 mm with the longitudinal joints if they consist of three or more sectors. When manufacturing pipes and shells consisting of two sectors, the central angle of the small sector α should not be less than 90°
- 5.15 It is allowed to manufacture the welded pipes and shells with nominal diameter more than 920 mm of 3 sectors and central angle of the small sector α should not be less than 90°
- 5.16 Categories of Welded Joints

The welded joints for equipment and pipelines of Nuclear Power Plants are divided in to following categories. Quality of weld and extent of NDE coverage are based on category of welds.

- Category I
- Category II
- Category III

Categories II and III are further subdivided into following subcategories

- Sub-category IIa
- Sub-category IIb
- Sub-category IIIa
- Sub-category IIIb
- Sub-category IIIc

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6 WELDING OF CLADDED MATERIALS

- 6.1 In preparing for welding parts made of two-layer steels, the cladding layer on sections adjoining the edges to be welded (on the side of their opening), and also in areas of making angular welds should be removed.
- 6.2 The width of the cladding layer removal zone should be at least 5 mm in manual arc welding with covered electrodes and argon- arc welding.
- 6.3 For angular and T joints, the cladding layer removal zone should go beyond the angular weld limits by at least the specified width values.
- 6.4 For welded joints whose base layer is made pearlitic steels is subjected to ultrasonic and/or radiographic examination before the cladding layer is applied, the width of cladding layer removal zone should be such as to make provision for the specified examination.
- 6.5 In making welded joints with removal of the cladding layer, the first welding is of base layer made of pearlitic steel and then welding of the cladding layer
- 6.6 The base layer should be welded with the use of welding materials intended for welding of parts made of base layer steel parts
- 6.7 Welding of cladding layer comprises performance of grooving and protective weld cladding (refer sketch in annexure-5).
- 6.8 The protective and grooving weld surfacing with the aid of arc welding with covered electrodes should be in separate lengthwise beads at a width not exceeding three diameters of used electrode rod. In case specified in the working documents, the grooving weld surfacing beads width is allowed to be increased up to four diameters of electrode rod

7 JOINT PREPARATION

- 7.1 The edges surface of the parts of welding should be prepared by mechanical treatment (Machining, Grinding)

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- 7.2 The edges of the parts made of carbon and silico-manganese pearlitic steels are allowed to be prepared by oxygen, air arc or plasma arc cutting with subsequent mechanical treatment until the traces of cutting are removed (1.5 mm minimum)
- 7.3 When it is required to prevent the development of the cracks, cutting should be made by preliminary heating of the metal as specified in the production process documentation
- 7.4 The shape and structural elements of part edges prepared for welding shall meet the requirements of these guidelines or drawing.

8 FIT-UP

- 8.1 All weld joint fit up shall comply with the tolerances specified in the drawings.
- 8.2 Before fit up of the weld joint, the profile and dimensions of the weld end preparation should be checked. If the specified tolerances are exceeded, this shall be corrected by grinding, machining.
- 8.3 Fit-ups should be examined prior to welding the root pass

9 WELD PROFILE

- 9.1 The weld metal reinforcement shall not exceed the limits specified in respective standards.
- 9.2 The misalignment of faces of the parts assembled for arc welding with two side preparation of edges should not exceed 0.5mm at their rated section up to 1mm inclusive, half the rated size of the faces at its value above 1 up to 4 mm inclusive and 2 mm at a rated size of faces exceeding 4 mm.
- 9.3 The dimension of convexity of the weld root during one-sided welding of pipes without backing rings and the fusion of the edges and backing ring in the course of welding should meet the requirement specified.

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10 WELDING OF STRUCTURAL ATTCHMENTS, HANGERS AND SUPPORTS

10.1 The welded joint should normally be located outside the supports

The supports may be located over the welded joints provided the following requirements are simultaneously met with

- Construction and location of the supports make it possible to inspect during operation a welded joint arranged under the support.
- When manufacturing or mounting the equipment, the welded joints should be subjected to the ultrasonic or radiographic test and section of the welded joint located under the support by the magnetic powder or capillary test

10.2 The welded pipe branches should meet the following requirement

- No circumferential welded joints can be made on the branches with the longitudinal joint within the curvilinear section

10.3 When welding the plates intended for supports and hangers to the pipeline consisting pipes with the spiral joints, the distance between the edge of the corner joint used to weld the plate and end of the butt spiral joint of the pipe should not be less than three nominal thickness values of the pipe wall

11 TACK WELD

11.1 All tack welds shall be made using qualified procedure and qualified welders. Any preheat requirements specified in the welding procedure shall also be apply to tack welds.

11.2 The number and size of tack welds shall be kept as small as is consistent with adequate strength and joint alignment.

11.3 As the welding proceeds, tack welds shall be either removed completely or shall be properly prepared by grinding or fitting their stopping and starting ends so that they may be satisfactorily incorporated into the final weld.

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12 REPAIRS

- 12.1 All defects detected in welded joints and surface articles during their non-destructive examination should be subjected to correction.
- 12.2 The surface defects should be corrected mechanically with provision for continuous transition in the areas of the grooves (by abrasive tools, cutting, or chipping with subsequent grinding).
- 12.3 Correction of surface defects without subsequent welding is allowed on following welded joints.
- On welded joints with permanent thickness of the weld and base metal at the area of maximum depth of the groove should not be less than 75% of it rated thickness.
- 12.4 The defects resulting from welding up of grooves in welded joints made by the arc welding and subject to thermal treatment, should be corrected after tempering of the welded joint (pretempering, intermediate, or final tempering).
- Defects are allowed to be corrected before the welded joints are tempered, if they are allowed to be cooled down to room temperature after termination of welding.
- 12.5 The internal defects (defective areas) should be corrected mechanically (by abrasives tool, cutting, or chipping with subsequent grinding).
- 12.6 In correcting defects in the course of carrying out welded joints, the following requirement should be met
- In detecting cracks, welding should be stopped and only after removal of the cracks, rewelding may be started by taking measures that could prevent their origination
 - In detecting burns of the backing ring, the pipe welded joints inaccessible for welding on the inner side should be completely removed and made new (if it is possible to correct the defect without cutting)
 - The number of corrections of the weld root on the same section should not exceed three

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13 SEAL WELDS

- 13.1 Seal welding shall be done by qualified welders and in accordance with approved procedure
- 13.2 Threaded joints that are to be seal welded shall be made without the use of a thread lubricating compound
- 13.3 Seal welds should not be considered as contributing to the strength of the joints. Backing off to correct misalignment of screw connections is not permitted.
- 13.4 The threads for making the joint shall be adequately prepared by grinding and circumferentially covered by seal weld. The surface of the seal weld shall merge smoothly into the parent metal surface and shall be suitable for the proper interpretation of non-destructive examination of the weld.

The details of welding wire, covered electrodes, flux used in different class of steel is given in Annexure 1

14 SHIELDING AND BACKING GAS

The rate of flow of gas (The purity of Argon gas should be 99.9%) for shielding purposes is given in annexure 2

15 HEAT TREATMENT OF WELDS:

- 15.1 The erection of equipments and pipelines supplied from Russian federation may require welding, preheating and post weld heat treatment at site.
- 15.2 Procedures for welding of similar materials (i.e. alloy steel to alloy steel), building of austenitic SS on alloy steel and welding of branch connections/supports etc on equipments shall be made and approved taking into account the requirement specified in Russian specification for welding these items. For welding, building up, preheating and PWHT of these alloys, the requirement of RTD 2730.300.02.91 and

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PNAE-G-09-89 shall be followed the thermocouples and recorders should be calibrated and record chart shall be provided.

- 15.3 Up to 12 mm of CS plates/flats can be welded to any thickness of 10GN2MφA steel without preheating if it is followed by PWHT.
- 15.4 The preheat and additional heating of the parts to be welded should be heated with the aid of electric, gas or other heating devices that provides the required heat up of weld joint.
- 15.5 The minimum temperature of preheating in welding parts depending on the steel grade and thickness of the parts to be welded as given in the table (refer annexure-3).
- 15.6 Maximum temperature of heating should not be exceeding the specified minimum temperature by more than 150°C.
- 15.7 When welding parts featuring different thickness, minimum temperature is specified in the working document and when this temperature is not specified in the working document, then refers the annexure 1/3 for the rated thickness of the wall.
- 15.8 Welding of the parts made of carbon and silico-manganese steels with anticorrosion cladding is performed with no heating.
- 15.9 When depositing an anticorrosion coating on parts made of the alloyed steels, the minimum temperature of heating is defined depending on the grade of the steel and thickness of the parts being faced as specified in the annexure 2/3.
- 15.10 The need for and type of thermal treatment to be performed on welded joints and faced articles are specified in compliance with the requirements of these guidelines and specified in the drawings.
- 15.11 If no thermal recovery is specified, the welded joints should be kept under conditions during the time interval between end of welding and start of thermal treatment (refer annexure 3/3).

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- 15.12 Minimum temperature and duration of thermal recovery are given in table 14 (refer annexure 3/3). Maximum temperature of thermal recovery should not exceed the 100°C of minimum temperature mentioned in an annexure 3/3.
- 15.13 The temperature of the furnace, when loading the welded article therein for thermal treatment, should not be more than 300°C the temperature of the metal subject to thermal treatment.
- 15.14 In performing precladding of edges of parts made of pearlitic steels and high chromium steels with austenitic filler materials, heating is effected in cladding the first layer only. For the necessity and minimum temperature of the specified heating, refer to annexure 1/3.
- 15.15 Parts made of pearlitic steels and high chromium steels (whose edges are preliminary cladded with austenitic filler materials) are welded (between themselves and also with parts made of austenitic steels) with no heating.
- 15.16 In carrying out precladding of edges of parts made of pearlitic class with high chromium filler materials, the minimum heating temperature should not below 100°C.

16 WELDING OF GI PIPES

- 16.1 The joint design, welding and inspection shall be as specified for non-galvanized pipes mentioned in this specification.
- 16.2 Joints must be thoroughly cleaned immediately prior to welding to remove all oxides, paints, oil, grease, dust, etc. Zinc coating shall be removed prior to welding.

17 EXAMINATION METHODS AND REQUIREMENTS

Nondestructive inspection of the quality of welded joints and coated metal should be performed by the methods prescribed in working documents.

- With regard to the scope of inspections, the nondestructive inspection is subdivided into 100% inspection and selective inspection (scope 50,25,15,10 or 5%)

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- If welded joint is subject to mandatory radiographic and ultrasonic inspection, the radiographic inspection may be performed before thermal treatment with mandatory 100% ultrasonic inspection after thermal treatment
- The 100% inspection should be carried over the entire length of each welded joint of the coated surface
- Selective inspection of individual areas is prescribed for circular welded joints of parts with rated outside diameter over 250 mm
- If any defects are discovered during the selective inspection by any method, additional inspection should be carried out by the same method in twice the original scope (in case of a
- 50% selective inspection, it is necessary to carry out 100% inspection)
- The sensitivities of the used inspection methods should be sufficient for discovering the discontinuities
- The inspected zone should include the entire volume of the weld metal and the adjoining areas of the base metal on both side of the weld
- The inspected zone for butt welds made by arc welding, width of weld should not be less than 5 mm at thickness of the 5 mm inclusive and not less than 20 mm at a rated thickness of the welded parts above 20 mm
- If the welded joint is accessible for visual inspection on both sides, these joints should be examined both from internal and external sides
- The radiographic inspection of corner, Tee, edge and overlap welded joints should be undertaken only in the case when the summery radiation thickness of the material inspected does not exceed 100 mm
- If the welded joint has to be subjected to selective radiographic and ultrasonic inspection, but the later is technically impossible, the scope of radiographic inspection should be doubled
- The quality of Tack welds should be inspected visually, while their dimension and layout are checked by measurement

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Methods and scope of Nondestructive inspection of welds of parts made of pearlitic class and high chromium steels is given in Annexure 4

18 REFERENCES

- Regulation for Design and safe operation of the atomic power plant equipment and pipelines - PNAEG-7-008-89
- Welding and Facing guidelines - PNAEG-7-009-89
- Welded joints and overlays inspection regulation - PNAEG-7-010-89
- Regulation to permit welders to work on the equipment and pipelines at Nuclear Power Plant - PNAEG-7-003-87
- GOST 6996-66
- Methods for testing the resistance to Intercrystalline corrosion - GOST 6032-84
- Methods of determination of mechanical properties of welded joints - GOST 1497-73
- Static tensile test for welded joints - GOST 1497-73.
- Impact Bending Test for welded joints GOST 9454-78

Records

- 1) Welding Procedure Specification (WPS) –Sample Form-A
- 2) Welding Procedure Qualification Record (PQR) –Sample Form-B

TECHNICAL CONDITIONS OF CONTRACT (TCC)

FORM-A WELDING PROCEDURE SPECIFICATION (WPS)

Company Name _____ By _____

Welding Procedure Specification No. _____ Date _____ Supporting PQR No. (s) _____

Revision No. _____ Date _____

Welding Process(es) _____ Type(s) _____

(Automatic, Manual, Machine, or Semi-

Auto)

JOINTS

Joint Design _____

Backing (Yes) _____ (No) _____

Backing Material (Type) _____

(Refer to both backing and retainers)

☐ Metal ☐ Nonfusing Metal

☐ Nonmetallic ☐ Other

Sketches, Production Drawings, Weld Symbols or Written Description Should show the general arrangement of the parts to be welded. Where Applicable, the root spacing and the details of weld groove may be specified.

(At the option of the Manufacturer, sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

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*BASE METAL

Group				No.
Specification	type	and	grade	
To				
Specification	type	and	grade	
Chem.	Analysis	and	Mech.	Prop.
Thickness Range :				
Base Metal:	Groove			Fillet

*FILLER METALS

Spec.				No.
Size	of	Filler	Metals	
Weld				Metal
Thickness Range :				
Groove				
Fillet				

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Electrode-Flux _____

(Class) _____

—

Consumable _____

Insert _____

* Each base metal-filler metal combination should be recorded individually.

Note:

Welding Process: SMAW – Shielded Metal Arc Welding (coated electrodes)

GTAW/TIG – Gas Tungsten Arc Welding, Tungsten – inert gas welding

GMAW – Gas Metal Arc Welding – Gas may be CO²/Argon, etc.

POSITIONS		POSTWELD HEAT TREATMENT	
Position(s) of Groove _____		Temperature Range _____	
Welding Progression Up _____ Down _____		Time Range _____	
Position(s) of Fillet _____			
PREHEAT		GAS	
Preheat Temp. Min. _____		Percent Composition	
Interpass Temp. Max. _____		Gas(es) (Mixture) Flow	
Rate			
Preheat Maintenance _____		Shielding _____	
(Continuous or special heating where applicable should be recorded)		Trailing _____	
		Backing _____	

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ELECTRICAL CHARACTERISTICS				
Current AC or DC _____ Polarity _____				
Amps (Range) _____ Volts (Range) _____				
Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below).				
Tungsten Electrode Size and Type				
(Pure Tungsten, 2% Thoriated, etc.)				
Mode of Metal Transfer for GMAW				
(Spray arc, short circuiting arc, etc.)				
Electrode Wire feed speed range				
TECHNIQUE				
String	or	Weave		Bead
Orifice	or	Gas	Cup	Size
Initial and interpass Cleaning (Brushing, Grinding, etc.)				

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Method of Back Gouging

Multiple or Single Pass (per side)

Multiple or Single Electrodes

Travel Speed (Range)

Peening : permitted/not
permitted

Weld Layer(s)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range	Other (e.g. Remarks, Comments, Hot Wire Addition, technique, Torch Angle, etc.)
		Class	Dia.	Type Polarity	Amp. Range			

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BASE METALS				POSTWELD HEAT TREATMENT			
Material		Spec.		Temperature			
_____		_____		_____			
Type	_____	of	Grade	Time			
_____	_____	_____	_____	_____			
Thickness	_____	of	Test	Coupon	Other		
_____	_____	_____	_____	_____	_____		
Diameter	_____	of	Test	Coupon	_____		
_____	_____	_____	_____	_____	_____		
Other				GAS			
_____				Percent Composition			
_____				Gas(es) Mixutre Flow Rate			
_____				Shielding	_____	_____	_____
_____				Trailing	_____	_____	_____
_____				Backing	_____	_____	_____
FILLER METALS				ELECTRICAL CHARACTERISTICS			
Specification				Current			
_____				_____			
Classification				_____			
_____				Polarity			
Filler	_____		Metal	_____			
_____	_____		_____	_____			
Size	_____	of	Filler	Amps			
Metal	_____		_____	_____			
Other	_____		_____	_____			
_____				Tungsten Electrode Size			
_____				_____			
Weld	_____	Metal	Thickness	Other			
_____	_____	_____	_____	_____			
_____				_____			

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POSITION Position of Groove Weld Progression (uphill, Downhill) Other	TECHNIQUE Travel Speed String or Weave Bead Oscillation — Multipass or Single Pass (per side) Single or Multiple Electrodes Other
PREHEAT Preheat Temp. Interpass Temp. Other	— — — — — — —

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PQR No. _____

Tensile Test

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location

Guided-Bend Tests

Type and Figure No.	Result

Toughness Tests

Specimen No.	Notch Location	Specimen Size	Test Temp.	Impact Values			Drop weight Break (Y/N)
				FT.lbs	% Shear	Mils	

Comments:

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Fillet-Weld Test	
Result – Satisfactory: Yes _____ No _____	Penetration into Parent Metal: Yes _____ No _____
Micro – Results _____ _____	
Other Tests *	
Type of Test _____ _____	
Deposit Analysis _____ _____	
Other _____ _____	
Welder's Name _____ Clock No. _____ Stamp No. _____	
Tests conducted by: _____ Laboratory Test No. _____	
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.	
Date _____ By _____ _____	

(Detail of record of tests are illustrative only and may be modified to conform to the type and number of tests required by the Code.)

* Hardness Inter-granular Corrosion Test, Ferrite Test, Micro examination & Macro examination as per requirement.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Annexure-1

(reference)

INDEX OF STANDARD-AND-ENGINEERING DOCUMENTATION FOR WELDING MATERIALS ALLOWED TO BE USED IN MANUFACTURE, ERECTION, AND REPAIR OF EQUIPMENT AND PIPELINES IN NUCLEAR POWER PLANTS

Welding materials ,		Designation of document
Description	Grade	
Welding wire	СВ-08А, СВ-08АА, СВ-08ГА	GOST 2246-70
	СВ-10ГА, СВ-10Г2, СВ-08ГС	
	СВ-12ГС, СВ-08Г2С, СВ-08ГСМТ	
	СВ-10НМА, СВ-08ХМ,	
	СВ-08ХМФА	
	СВ-10ХМФТ, СВ-08ХГСМА	
	СВ-08ХГСМФА, СВ-04Х2МА	
	СВ-13Х2МФТ, СВ-10Х11НВМФ	
	СВ-06Х14, СВ-06Х19Н9Т	
	СВ-08Х19Н10Г2Б	
	СВ-08Х19Н10М3Б	
	СВ-04Х19Н11М3, СВ-07Х25Н13	
	СВ-10Х16Н25АМ6	
	СВ-30Х15Н35В3Б3Т	
	СВ-06А	ТУ 14-1-1569-75
	СВ-10ГНМА, СВ-10ГН1МА,	ТУ 14-1-2860-79
	СВ-10ГН2МФА	
	СВ-10ХМФТУ	ТУ 14-1-3034-80
	СВ-12Х2Н2МА, СВ-12Х2Н2МАО	ТУ 14-1-2502-78
	СВ-09ХГНМТА,	ТУ 14-1-3675-83
	СВ-09ХГНМТАА-ВН	
	СВ-16Х2НМФТА	ТУ 14-1-3633-83
	СВ-01Х12Н2-ВН	ТУ 14-1-1212-74
	СВ-01Х12Н2МТ-ВН	ТУ 14-1-3595-83
	СВ-09Х16Н4Б	ТУ 14-1-1692-76
	СВ-03Х16Н9М2	ТУ 14-1-2208-77
	СВ-021Х17Н10М2-ВН	ТУ 14-1-1005-74
	СВ-04Х17Н10М2	ТУ 14-1-1959-74
	СВ-04Х20Н10Г2Б	ТУ 14-1-3252-81
	СВ-03Х24Н13Г2Б	ТУ 14-1-2205-77
	СВ-03Х15Н35Г7М6Б	ТУ 14-1-2143-77
	СВ-08АА-ВН	ТУ 14-1-4355-81
	СВ-03Х20Н45Г6М6Б-ВН	ТУ 14-1-2206-77
	СВ-06ХГСМТА,	ТУ 14-1-2808-79
	СВ-14Х12НВМФ	
	СВ-13Х2МФТА	ТУ 14-1-4370-87

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1	2	3
Welding strip	Cu-08X19H10Г2Б	ТУ 14-1-3146-81
	Cu-04X19H11M3	
	Cu-07X25H13,	
	Cu-10X16H25AM6	
	Cu-04X20H10Г2Б	ТУ 14-1-2270-77
	Hu-03X22H11Г2Б	ТУ 14-1-2750-79
	Cu-03X24H13Г2Б	ТУ 14-1-2207-77
Covered electrodes	Cu-03X15H35Г7M6Б	ТУ 14-1-2162-77
	ЦУ-5, ЦУ-6, ЦУ-7, ЦУ-7А	ОСТ 108.948.01-86
	ЦУ-2ХМ, ЦЛ-20, ЦЛ-21,	
	ЦЛ-25/1, ЦЛ-25/2, ЦЛ-32	Certificate ИЭ No. 223-73
	ЦЛ-38, ЦЛ-39, ЦЛ-45, ЦЛ-48,	
	ЦЛ-51, ЦЛ-59, ПТ-30, РТ-45А,	Certificate No. OC31-10-76 (A)
	РТ-45АА, ЦТ-10, ЦТ-15К,	
	ЦТ-26, ЦТ-26М, ЦТ-36М, ЦТ-45,	Certificate No. OC31-11-76 (A)
	ЦТ-48	
	ЦЛ-52	*
	ЗИО-8	
	ОЭС-4	Certificate No. OC31-11-76 (A)
	ОЭС-6	
	УОНИИ-13/45, УОНИИ-13/45А,	*
	УОНИИ-13/55, УОНИИ-13/45АА	
Welding flux	УОНИИ-13/55АА,	GOST 9466-75
	УОНИИ-13/10Х13, Н-3, Н-6,	
	Н-10, Н-20, Н-23, Н-25, РТ-45Б,	GOST 9467-75
	ЭА-395/9, ЭА-400/10У,	
	ЭА-400/10Т, ЭА-582/23,	GOST 9087-81
	ЭА-855/51, ЭА-898/21Б,	
	ЭА-902/14, ЭМ-959/52, А-1,	ТУ 5.965-11087-78
	А-1Т, А-2, А-2Т, КТЧ-7	
	АНО-4, МР-3	ТУ 5.965-11090-78
	ТМУ-21, ТМЛ-1У,	
	ТМЛ-3У	

1	2	3
Welding flux	АН-42, АН-42М, ОФ-6, ОФ-10 НФ-18М, КФ-16, КФ-19, КФ-28 ФЦ-11, ФЦ-16, ФЦ-16А, ФЦ-17 ФЦ-18, ФЦ-19, ФЦ-21, ФЦ-22	
Welding sticks made of lanthanide tungsten	- БЛ	Ту 48-19-27-77
Welding sticks made of yttrium tungsten	СВИ-1	ТУ 48-19-221-76
Welding sticks made of tungsten	ЭВЛ, ЭВИ-1, ЭВИ-2, ЭВИ-3, ЭВТ-15	GOST 23949-80
Gaseous and liquid argon	Highest and first quality	GOST 10157-79
Helium	-	ТУ 51-940-75
Gaseous commercial oxygen	First and second quality	GOST 5583-78
Gaseous and. liquid carbon dioxide	Highest and first quality	GOST 8050-85

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Annexure 1/2 (Annexure-2)

Manual Argon-Arc Welding with Non-consumable Electrode

Class of steel	Type of Welding joint	Rated thickness of parts at welding spot, mm	Diameter of tungsten electrode, mm	Diameter of filler wire, mm	Current Strength A		Argon flow rate l/min	
					Root Pass	Groove filling	Per torch	Per heave
Austenitic and pearlitic	1-23	Above 3 and upto 4 (inclusive)	1.6 – 4.0	1.6 – 2.0	45-90	50-70	8 – 10	4 – 5
		Above 4 and upto 6 (inclusive)	1.6 – 4.0	1.6 – 3.0		90-100	8 – 10	4 – 5
	2-03	Above 4 and upto 6 (inclusive)	1.6 – 4.0	-	70-100	100-	8 – 10	4 – 5
	2-04	Above 4 and upto 6 (inclusive)	1.6 – 4.0	-	80-110	140-160	8 – 10	4 – 5
Iron-nickel alloys	1-23	Above 3 and upto 4 (inclusive)	1.6 – 4.0	1.6 – 2.0	40-70	40-70	8 – 10	4 – 5
		Above 4 and upto 6 (inclusive)	1.6 – 4.0	1.6 – 2.0	65-80	65-80	8 – 10	4 – 5
	2-03	Above 4 and upto 6 (inclusive)	1.6 – 4.0	1.6 – 2.0	55-80	55-80	8 – 10	4 – 5
	2-04	Above 4 and upto 6 (inclusive)	1.6 – 4.0	1.6 – 2.0	60-90	60-90	8 - 10	4 - 5

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Annexure 2/2 (Annexure-2)

Manual Argon-Arc welding of pipelines of Austenitic class with non-consumable electrode in pulse operation

Rated thickness part at Welding spot, mm	No. of pass	Diameter of tungsten electrode , mm	Diameter of filler wire, mm	Pulse time, s	Break time, s	Welding Current A		Argon flow rate, l/min	
						Pulse	pilot	Per torch	Per heave
1.0-1.5	1	2.0	-	0.1-	0.15-	40-50	6-8	6-8	2-5
	2	2.0	1.2	0.15	0.25	40-50	-	6-8	2-5
				-	-				
2.0-2.5	1	2.0	-	0.4-	0.3-0.5	50-70	6-8	6-8	2-5
	2	2.0	1.6	0.6	-	50-70	-	6-8	2-5
				-					
Above 2.0 and up 4.0 (inclusive)	1	2.0-3.0	-	1.5-	0.3-0.5	105-	6-8	7-10	2-5
	2 and subsequ ent	2.0-3.0	2.0-2.5	2.0	-	125	-	7-10	2-5
				-		105- 125			
Above 4.0 and upto 9.0 (inclusive)	1	3.0	-	1.5-	0.3-0.5	140-	6-8	10-12	2-5
	2 and subsequ ent	3.0	2.5-3.0	2.5	-	180	-	10-12	2-5
				-		140- 180			
Above 9.0 and upto 20.0 (inclusive)	1	3.0-4.0	-	2.5-	0.3-0.5	150-	6-8	12-15	2-5
	2 and subsequ ent	3.0-4.0	3.0-4.0	3.0	-	200	-	12-15	2-5
				-		150- 200			

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Annexure –1/3 (Annexure-3)

Table 11. Minimum Temperature of Preheat and Additional Heat in Making Welded Joints

Grades of steels of parts to be welded	Rated thickness parts to be welded, mm	Heat-up minimum temperature, °C		
		in arc welding	in electroslog welding	in buttering with use of austenitic filler materials
1	2	3	4	5
Cr3en5, 10, 15, 15Л, 20, 20Л, 20K, 22K, 25Л	Up to 100 (inclusive)	-	-	-
	Above 100	100	-	-
10XCHД *	Up to 60 (inclusive)	Heat-up not required*	-	-
	Above 60	100	-	-
10XH1M	Up to 40 (inclusive)	Heat-up not required	-	-
	Above 40	100	-	50
15ГC, 16ГC, 09Г2C, 20ГCЛ, 16ГHMA	Up to 30 (inclusive)	Heat-up not required	-	-
	Above 30	150	-	150
10ГH2MΦA, 10ГH2MΦAJ, 15ГHМΦA	Up to 50 (inclusive)	50	-	-
	Above 50	120	100**2	100
12MX, 12MX, 15XM	Up to 10 (inclusive)	Heat-up not required	-	-
	Above 10 and up to 30 (inclusive)	150	50	100
	Above 30	200	100	150
20XM, 20XMЛ, 20XMA	Up to 6 (inclusive)	-	-	-
	Above 6	200	100	150
10X2M	Up to 6 (inclusive)	-	-	-
	Above 6	100	-	100
12X1MΦ *	Up to 6 (inclusive)	-	-	-
	Above 6 and. up to 30 (inclusive)	200	150	100
15X1M1Φ, 15X1M1ΦЛ	Up to 6 (inclusive)	-	-	-
	Above 6 and. up to 30 (inclusive)	250	200	150
	Above 30	300	250	200
15X2HMΦA, 15X2HMΦA-A,	Irrespective of thickness	150	150	150
15X3HMΦA, 15X3HMΦ-A	Irrespective of thickness	150	150	150
12X2MΦA	Up to 80 (inclusive)	200	100	150
	Above 80	200	150	150
15X2MΦA, 15X2MΦA-A, 18X2MΦA	Irrespective of thickness	200	150	150
08X13, 05X12H2M	Up to 6 (inclusive)	-	-	-
	Above 6	100	-	100
06X12H3Д	Up to 30 (inclusive)	-	-	-
	Above 30	100	-	100
12X11B2MΦ	Up to 30 (inclusive)	250	150	250
	Above 30	300	200	250

*Necessity of heating in welding parts made of steel, grade 22K, is established in consultation with the leading materials technology agency.

**With thickness of up to 150 mm, inclusive, heating need not be performed.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Annexure –2/3 (Annexure-3)

Table 12. Minimum Heat-up Temperature in Weld surfacing third Layer of Antirust Coating

Grade of steel of part being faced.	Type of filler material	Rated thickness of part being faced, mm	Minimum heat-up temperature, °C
20XMA	Strip	Irrespective of thickness	-
	Covered electrodes, wires	Up to 100 (inclusive)	-
		Above 100	100
10XH1M 10GH2MΦA 10GH2MΦЛ	Strip	Up to 100 (inclusive)	-
	Covered electrodes, wire	Above 100	50
		Up to 50 (inclusive)	-
15X2HMΦA 15X2HMΦA-A 15X3HMΦA	Strip	Above 50	50
		Up to 100 (inclusive)	-
	Covered electrodes, wire	Above 100	50
		Up to 100 (inclusive)	50
		Above 100	100
12X2MΦA 15X2MΦA 15X2MΦA-A 18X2MΦA	Stripe covered electrodes, wire	Irrespective of thickness	150

Annexure –3/3 (Annexure-3)

Table 13. Conditions of stay of butt welded joints in time interval between the end of welding and start of thermal treatment

Grades of steels of welded joints	Rated thickness of wall of parts being welded, mm	Minimum temperature of metal in welded joint zone, °C	Tolerable time interval, h
10GH2MΦA, 10GH2MΦЛ 15GHMΦA	Above 50	70	Unspecified
20XM, 20XML, 20XMA	Irrespective of width	Unspecified	72
10X2M	Above 30	100	Unspecified
12X1MΦ, 15X1MΦ	Above 6	Unspecified	72
05X12H2M	Above 30	80	Unspecified
15X2HMΦA, 15X2HMΦA-A 15X3HMΦA, 15X3HMΦA-A	Irrespective of thickness	150	Unspecified
12X11B2MΦ	Above 3	Unspecified	72
06X12H3Л	Above 10	100	Unspecified
12X2MΦA	Irrespective of thickness	175	Unspecified
15X2MΦA, 15XMΦA-A	Irrespective of thickness	200	Unspecified
18X2MΦA	Irrespective of thickness	300	Unspecified

Table 14. Conditions of Thermal Recovery of Butt Welded Joints Made by Arc or Electron-Beam Welding

Grades of steels of parts being welded	Rated thickness of wall of parts being welded, mm	Thermal recovery condition	
		minimum temperature, °C	minimum duration, h
10GH2MΦA, 10GH2MΦЛ 15GHMΦA	Above 50 and up to 110 (inclusive)	150	8
	Above 110	150	18
10X2M, 05X12H2M	Above 30	100	8
12X1MΦ	Above 6	130	8
15X1MΦ	Above 6	150	10
06X12H3Л, 15X3HMΦA 15X3HMΦA-A	Irrespective of thickness	150	12
08X13	Above 10	100	8

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Annexure –1/4 (Annexure-4)

Methods and scope of Non-destructive inspection of welded joints of tubes in tube plate and Headers is given below in table below

Category of welded joint	Scope of Inspection %			
	Visual and Measuring	Capillary and magnetic powder	Radiographic	Pressure tightness
I	100	100	100	100
IIa	100	50	50	-
IIB, IIIa	100	-	25	-
IIIB	100	-	10	-
IIIC	100	-	-	-

Methods and scope of Non-destructive inspection of buttering parts from steel of Pearlitic class and from High Chromium steels

Type of welding	Category of welded joint	Scope of Inspection, %				
		Visual and Measuring	Capillary and Magnetic Powder	Radiographic		Ultrasonic
				Up to DH = 325 mm	Over DH = 325 mm	
Buttering with austenitic	I	100	100	100	100	100
	IIB, IIIa	100	100	100	100	50
	IIIB					

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filler materials	IIIc	100	100	100	100	25
		100	100	100	100	10
Buttering with high-chromium or pearlitic filler materials	I	100	100	100	100	100
	IIa	100	50	50	100	100
	IIB	100	25	25	50	100
	IIa	100	25	10	25	100
	IIIB, IIIc	100	-	-	-	100
Coated anticorrosive coating	-	100	-	-	-	100
Reinforcing surfacing						

Annexure-5

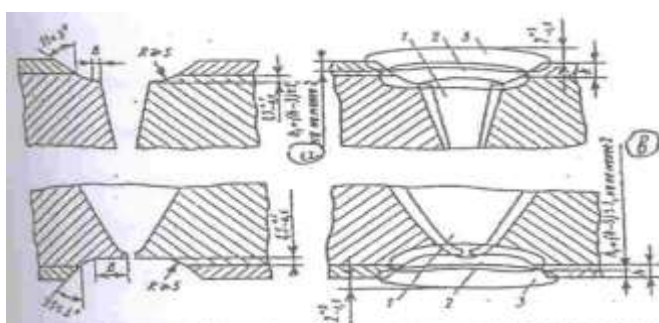


Fig. 1. Diagram Showing Grooving and Making of Welded Joints of Two-Layer Steel Parts
 1 - weld; 2 - groove weld surfacing; 3 - protective weld surfacing
 a) but at least 2, b) but at least 2

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2.2.6 RADIOGRAPHY FOR NIEP ERECTION PACKAGE WORKS

CONTENTS

S.No	Description
1	Scope
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5	RT Equipments / Accessories
5.1	RT Films
5.2	Image Quality Indicators
6	Examination By Radiography
6.1	Radiography Techniques.
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Annexure I	References
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Annexure IV	Selection of IQI
Annexure V	Shooting diagrams
Annexure VI	RT Acceptance Standard Table (Table 13 of PNAE

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1. SCOPE: This specification describes the methods and techniques of Radiography examination of weld joints equipments and piping during construction of KKNPP.
2. APPLICATION: This Specification is applicable for all equipments/piping works during construction/erection of KKNPP. This is a general specification which shall be followed. Based on this specification, the contractor shall prepare the detailed procedure and get it approved by KKNPP. However, any special requirements in the working documents shall be covered in separate procedures.
3. APPLICABLE DOCUMENTS AND STANDARDS:
Refer list of documents enclosed as annexure- I (i.e References).
4. PERSONNELQUALIFICATION: RT shall be carried out by qualified personnel or by personnel having sufficient experience and under the supervision of qualified radiography operators and interpretation shall be done by RT interpretor having training in interpretation of weld radiographs and/or having RT Level-II qualification. A qualified Radiography site in charge shall handle the RT facility and works at site and shall be responsible for safety and quality of works related to Radiography.
5. RT EQUIPMENTS/ACCESSORIES: only BHEL/NPCIL concurred models/make of RT cameras and X-ray machines shall be deployed for RT works. Some of the approved brands of RT Cameras and x-ray machines are given in Annexure-II.

The RT camera must provide sufficient shielding against high curie Co-60/Ir-192 source and shall have guide tube and handle for RT from a remote safe distance. A calibrated survey meter shall be used to check the radiation level in the vicinity of radiography source.

When X-ray machine is used for examination it must have proper Kv rating (say upto 400Kv) with current(exposure) controlling arrangement for x-raying thickness as low as 3mm. Only approved brands of X-ray machines shall be used.

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5.1 RT FILMS:

Where thickness involved is less and high contrast is desired slow speed RT films shall be used and for higher thickness medium speed films may be used. Some of the approved brands of RT films in descending order of contrast (speed ascending order) are given in Annexure-I.

Intensifying screens made of pure Lead or any alloy of 6% antimony and 94% Lead may be used.

Screen shall be free from surface streaks of lower atomic number materials and from wrinkles, dirt, grease, lint and scratches. Screens showing evidence of physical damage shall be discarded.

Screens shall be in intimate contact with both sides of the film during exposure.

To avoid back scatter radiation affects, protective screens(Lead foil or high atomic no. material) of thickness from 0.5mm minimum to 1.5 mm shall be placed between film and the specimen being radiographed.

5.2 IMAGE QUALITY INDICATORS(IQI) OR PENETRAMETERS:

Russian or DIN Wire type IQI shall be used to ascertain the quality of radiography technique. The penetrometer will preferably be placed on source side. If it is not possible to place the IQI on source side, they may be placed on film side. The selection of IQI shall be based on the thickness and the sensitivity requirements of the job under examination. If any specific requirements are not given, Tables given in Annexure-IV can be used for selection of IQI.

The radiograph must have optical density (O.D) of 1.5 to 3.5 for satisfactory results. Calibrated densitometers shall be used to measure the density. Location marker and Lead identification numbers as per standard practice shall be used to identify the weld joints being radiographed.

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6. EXAMINATION BY RADIOGRAPHY:

For specific job, a specific RT/X-ray technique sheet shall be made and approved by Head QA, KK site. The technique sheet shall cover material specification (Thickness, dia), welding process, details of Radiography source/X-ray machine, RT films, intensifying screens, penetrameters and their placement. A shooting sketch of the Radiography technique proposed shall also be enclosed. A sample of technique sheet is enclosed as Annexure-III. Based on above procedure the technique should be actually demonstrated before start of actual job radiography.

6.1 RADIOGRAPHY TECHNIQUES:

The butt joints and fillet welds (wherever specified) of equipments/pipelines shall be radiographed according to the diagrams given in Fig:3(Ref: Annexure-V as per PNAEG-7-17-89). Diagrams a, b, f, g and h show single wall exposure. If possible, the source should be located inside the article being radiographed.

Fig. 3(f) shows panoramic arrangement of RT and is recommended upto 2 meter dia.(irrespective to %age of RT) and for 100%(Full Radiography) over 2 meter of diameters.

Other arrangements, like double wall exposure (single wall viewing), double wall exposure (elliptical for dia. below 100 mm and high thickness) shall also be used where applicable.

For pipe branches/nozzles, RT techniques as per Fig.4 (Annexure-V) shall be used.

Any technique other than mentioned above shall be elaborated by technique sheet (by the contractor) and get it approved by BHEL/NPCIL prior to execution of work.

Minimum four no. of IQI shall be placed for panoramic technique, each IQI placed in each sector to cover full diameter.

The geometrical un-sharpness shall not exceed half the sensitivity up to 2mm and maximum 1.0mm for sensitivity more than 2mm.

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The angle between the radiation direction and normal to the film within the limits of section inspected in one exposure shall not exceed 45°.

Suitable no. of exposures shall be taken to cover the scope of radiography specified and to avoid any missing details due to enlargement on images/details towards the ends showing thickness of the pipe being radiographed.

An overlapping of minimum 20mm of weld length shall be provided, when more than one segment of the same weld joints are radiographed.

The width of RT film shall be taken to cover the weld as well as minimum 20mm of heat affected zone on both sides of the weld width (Minimum 50mm of HAZ in case of electro slag welding)

Use of compensators shall be made, (where the joint configuration causes a portion of RT film hanging and in direct exposure to the radiation beam) to provide material cover on RT film outside the radiographed thickness.

6.1.1 Source to object distance:

- There are many factors affecting the source to film distance, for the all the techniques shown in the above sketch.
- Final values shall be decided by the approved procedures and the technique sheets.
- The source to surface of the welded joint (f in the above sketch) selected in such a way that
 - When film is located close to the welded joint being inspected , the lack of geometrical sharpness of the images of the defects on the pictures shall not exceed the half of the required sensitivity of inspection at sensitivity of up to 2mm and shall not exceed 1 mm at sensitivity over 2mm.
 - The relative enlargement of the dimensions of the images of the defects located from the side of the source of radiation (relative to the defects located from the side of the film) shall not exceed 1.25.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- The angle between the radiation direction and normal to the limits film within the limits of the section inspected at one exposure shall not exceed 45°.
- Selection of distance from radiation source to welded joint being inspected and length or quantity of sections to be inspected.

f = distance from the radiation source to the weld joint.

h = Radiation thickness of the section being inspected, mm

Ø = the maximum size of the focal, spot of the radiation source, mm.

K = the required sensitivity of the inspection, mm.

D = Outer dia of the pipe

d = Inner dia of the pipe

$C = 2 \text{ } \varnothing / K \text{ at } \varnothing / K \geq 2$

$C = 4 \text{ at } \varnothing / K < 2$

For fig (C) in the techniques shown in the above figure , $f \geq C D$

For fig (d) , $f \geq 0.5 [1.5C(D-d)-D]$

For fig (e) , $f \geq 0.5 [C(1.4D-d)-D]$

Typical Calculation for the technique sheet given below:

D = 38mm, d = 31mm, K = 0.2mm, Ø = 2.7mm,

$\varnothing / K = 2.7 / 0.2 = 13.5$, $C = 2 \times 2.7 / 0.2 = 27\text{mm}$

Value of CD = 27 x 38 = 1026mm, $f \geq 1026$ and selected value is 1050mm which fulfil the requirement.

- Above illustration shows that the source to object distance may vary from zero to above one meter.
- This distance will increase the exposure time for carrying out radiography, which will reduce the productivity.
- Also for aligning the source to required orientation and distance will take great amount of time which will affect the productivity.
- Quoted rate shall include this entire factors considering into account.

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7. GENERAL REQUIREMENTS:

7.1 SAFETY DURING RADIOGRAPHY: All radioactive sources shall be handled by qualified personnel only. Storage, transportation, handling etc shall be done only from radiography source room approved by statutory authority. To avoid radiation exposure to general construction workers, RT shall be performed preferably during night time or in case of urgency during such time so as not to allow any exposure to general public. Suitable barricading of the area, where radiography is being is done shall be done with "Danger" sign. The personnel performing RT shall wear TLD and carry calibrated dosimeter and survey meters to measure the dose and radiation level.

7.2 STORAGE AND PROCESSING OF FILMS:

Suitable dark room with controlled atmosphere shall be established with provision of processing tanks, dry work bench, film cutters, safe light for loading and processing of RT films, Illuminator for interpretation of films and storage space for processed radiographs. RT film shall not be exposed to temperatures more than 26°C and high humidity conditions for longer time. Approved brands of developer, fixer and stop bath solutions shall be used. Depleted or contaminated solutions shall be replaced when detected or film artifacts attributable to poor quality of developer/fixer are noticed.

Developer temperature shall not exceed 20°C. Washing of fixed radiographs shall be done in running water for at least 30 minutes or alternately each radiograph shall be washed thoroughly in running water for at least 30 seconds.

Drying of processed radiographs shall be done away from dust, dirt or area susceptible to contamination of radiographs. Use of good quality wetting agent, rubber wiper may also be done.

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The accepted films shall be stored in controlled atmosphere and dust free room. The films shall be segregated according to system and circuit wise until handing over to BHEL with proper indexing no. at the time of handing over the system.

8.0 ACCEPTANCE STANDARDS:

The radiographs shall be interpreted by qualified inspectors and RT results Recorded in Radiography inspection reports. RT acceptance standards shall be as per working documents and approved standards. The following defects are not acceptable.

- i) Any indication representing crack, lack of penetration and lack of fusion.
- ii) Defects which are beyond the acceptance levels of Tables 13 of PNAE-G-07-10-89 (Ref; Annexure-VI, given as indicative of acceptance standards)

9.0 REPORTING OF RT RESULTS:

Radiography inspection report format shall be agreed with the Engineer/Head QA. It shall cover the following details:

Contract details with W.O no. and date

Job (article) description(Thickness, diameter etc), system, KKS code etc.

Drawing No. of weld joint, process, Jt. Category.

RT procedure/Technique sheet No.

Applicable standard

Radiography source type, strength, size, Kv and mA in case of X-ray.

IQI designation/placement, sensitivity

Radiographer name, date of radiography,

RT film type, size,

Scope of RT i.e 100%, random etc.

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Fresh, Repair, retake or repeat shot identification

Jt, numbers, Segments radiographed with interpretation results

Remarks, observations for final inspection, interpreting BHEL/NPCIL

inspector Signature of interpreter with date.

Annexure - I

REFERENCES:

- i) PNAE-G-007-017-89: Unified control techniques of basic materials (Semifinished products) welded connections and claddings of nuclear plant unit equipments and pipelines -Radiography control.
- ii) PNAE-G-007-010-89: Welded connections and claddings of nuclear plant unit equipments and pipelines- Inspection regulations.
- iii) GOST 7512-82: Non-destructive inspection. Welded joints. Radiographic method.
- iv) SNiP 3.05.05-84: Technological equipments and technological pipelines.
PB.03.75-94, Rules for and safe operation of Steam and Hot water pipelines.

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Annexure-II

Equipments/Accessories:

RT CAMERA:

The commonly brands of RT cameras which are approved to be used in NPCIL NPPs are as given below-

- i) Teletron SU-50A
- ii) Tech-op
- iii) Spec-2T

X-Ray Machines (Preferably to be used for radiography of small thickness say upto 19mm)

- i) X-ray machine of Philips make (Suitable KV and Ampere rating.)
- ii) X-ray machine of Andrex make (Suitable KV and Ampere rating.)
- iii) BALTEAU-NDT, Model C-ram-235, 50 to 235 Kv, 7 Amp.

RT Films:

- i) NDT 45, Afga D2, Kodak-M., RT-5 (Slow speed films)
- ii) NDT 55, D4, Kodak-Mx 125., RT-4Sh, RT-4M (Medium speed films)

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Annexure-III

TECHNIQUE SHEET FOR RADIOGRAPHY:

Technique sheet no. KKNPP/RT/

1. Scope:
2. Personnel Qualification:
3. Material Specification:
4. Welding Process:
5. Thickness:
6. Surface condition and reinforcement:
7. Source of Radiation/X-ray machine parameters (e.g curie and mm size in source and Kv/mA of X-ray machine).
8. Type of film and size:
9. Technique/No. of exposure and shooting sketch reference:
10. Type of screen:
11. Penetrameter type and placement:
12. Sensitivity required:
13. Source to film distance:
14. Geometric unsharpness:
15. Optical density of film.
16. Density variation:
17. Acceptance standards.
18. Reporting format.

Prepared by:

Reviewed by:

Approved By: (NPCIL QA)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Annexure-IV

Selection of IQI:

TABLE: Guidelines for IQI Selection.

PENETRATOR DESIGNATION, THICKNESS AND WIRE DIAMETERS
(FOR SYSTEMS COVERED UNDER QA1, QA2 and QA3 Categories)

Table of testing sensitivity for radiographs

Radiation Depth (at place of installation of sensitivity standard) in mm	Sensitivity Rating		
	1	2	3
Up to 5	0.10	0.10	0.20
Over 5 up to 9 inclusive	0.20	0.20	0.30
Over 9 up to 12 inclusive	0.20	0.30	0.40
Over 12 up to 20 inclusive	0.30	0.40	0.50
Over 20 up to 30 inclusive	0.40	0.50	0.60
Over 30 up to 40 inclusive	0.50	0.60	0.75
Over 40 up to 50 inclusive	0.60	0.75	1.00
Over 50 up to 70 inclusive	0.75	1.00	1.25
Over 70 up to 100 inclusive	1.00	1.25	1.50
Over 100 up to 140 inclusive	1.25	1.50	2.00
Over 140 up to 200 inclusive	1.50	2.00	2.50
Over 200 up to 300 inclusive	2.00	2.50	-
Over 300 up to 400 inclusive	2.50	-	-

Note: When using the wire sensitivity standards values 0.30, 0.60, 0.75 and 1.50 mm are replaced with values 0.32, 0.63, 0.80 and 1.60 mm.

Depending upon the wire diameter required as per specification/drawings the IQI selection can be made from standard sets of GOST/DIN type penetrameters as given below.

As per DIN 54:109/ISO

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IQI Designation:

Wire Dia. Range:

1 ISO 7

0.8 mm to 3.2mm

6 ISO 12

0.25 mm to 1.0mm

10 ISO 16

0.10 mm to 0.40mm.

As per GOST 7512-82

IQI Designation:

Wire Dia. Range:

Standard No. 1

0.05mm to 0.2mm

Standard No. 2

0.10mm to 0.4mm

Standard No. 3

0.32mm to 1.25mm

Standard No. 4

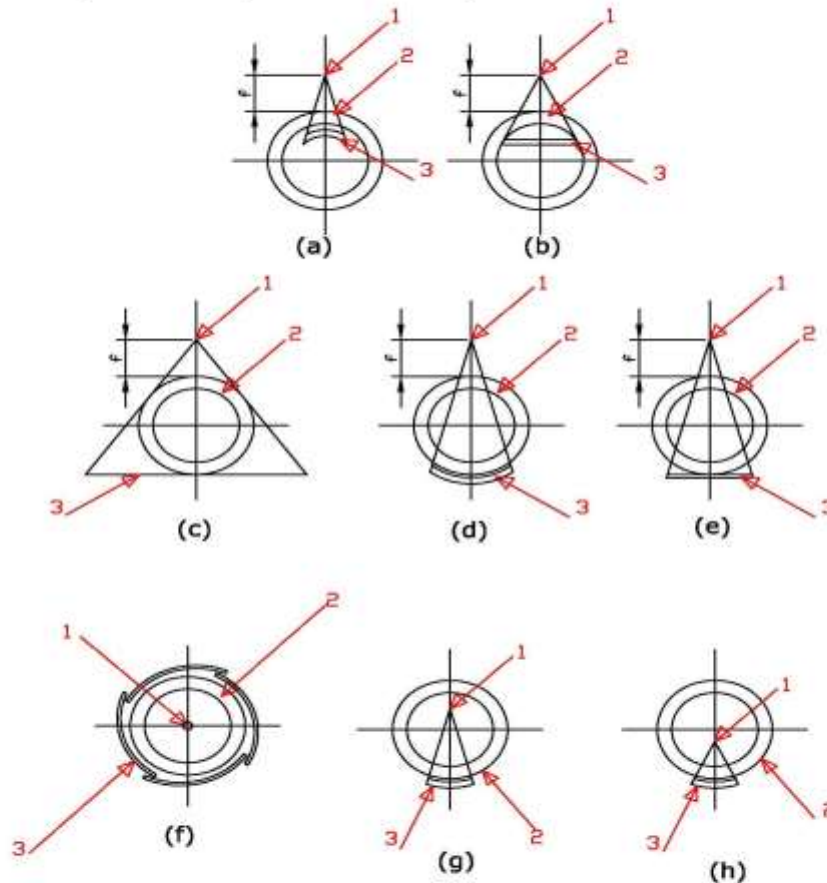
1.00mm to 4.0mm

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Annexure-V

Shooting sketches as per PNAE-G-7-10-89

1) Diagrams of inspection of Butt - Circular welded joints of Cylindrical and Spherical Hollow articles.



1) Radiation source 2) Section Under Inspection
3) Cassette
 f = Distance of source of radiation to welded joint being inspected

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Annexure-VI

Table : 13 of PNAE-G-7-10-89(Acceptance standards as indicative only)

Table 13: Norms of Individual and Clustered Inclusions Permissible in Welded Joints during Radiographic Inspection

Rated thickness of welded joints at point of welding, mm	Required sensitivity of inspection, mm	Individual and clustered inclusions				Individual large inclusions		
		Permissible maximum size		Permissible number of inclusions, and clusters in any section of welded joint 100 mm long	Permissible total reduced area of individual or cluster inclusions in any sections of welded joint 100 mm	Permissible		Permissible number in any section of welded joint 100 mm long
		inclusion, mm	cluster, mm			maximum size, mm	maximum width, mm	
1	2	3	4	5	6	7	8	9
<i>Welded joints of the I category</i>								
Over 1.0 to 1.5 inclusive	0.1	0.2	0.3	10	0.15	3.0	0.2	1
Over 1.5 to 2.0 inclusive	0.1	0.3	0.4	10	0.3	3.0	0.3	1
Over 2.0 to 2.5 inclusive	0.1	0.4	0.6	10	0.6	3.0	0.4	1
Over 2.5 to 3.0 inclusive	0.1	0.5	0.8	10	1.0	3.0	0.5	1
Over 3.0 to 4.5 inclusive	0.1	0.6	1.0	10	1.4	3.0	0.6	1
Over 4.5 to 6.0 inclusive	0.2	0.8	1.2	11	2.3	3.0	0.8	1
Over 6.0 to 7.5 inclusive	0.2	1.0	1.5	11	4.0	3.0	1.0	1
Over 7.5 to 10.0 inclusive	0.2	1.2	2.0	12	5.5	3.5	1.2	1
Over 10.0 to 12.0 inclusive	0.2	1.5	2.5	12	7.5	3.5	1.5	1
Over 12.0 to 14.0 inclusive	0.3	1.5	2.5	13	9.0	4.0	1.5	1
Over 14.0 to 18.0 inclusive	0.3	2.0	3.0	13	11.0	4.0	2.0	1
Over 18.0 to 21.0 inclusive	0.3	2.0	3.0	14	14.0	4.0	2.0	1
Over 21.0 to 24.0 inclusive	0.4	2.0	3.0	14	17.5	5.0	2.0	1
Over 24.0 to 27.0 inclusive	0.4	2.5	3.5	15	20.0	5.0	2.5	2
Over 27.0 to 30.0 inclusive	0.4	2.5	3.5	15	23.0	6.0	2.5	2
Over 30.0 to 33.0 inclusive	0.5	2.5	4.0	16	26.0	6.0	2.5	2
Over 35.0 to 40.0 inclusive	0.5	3.0	4.5	17	30.0	7.0	3.0	2
Over 40.0 to 45.0 inclusive	0.6	3.0	4.5	18	34.0	8.0	3.0	2
Over 45.0 to 50.0 inclusive	0.6	3.0	4.5	19	38.0	9.0	3.0	2
Over 50.0 to 55.0 inclusive	0.6	3.0	4.5	20	42.0	10.0	3.0	2

Table 13 (continued)

1	2	3	4	5	6	7	8	9
Over 55.0 to 65.0 inclusive	0.75	3.5	5.0	21	48.0	10.0	3.5	2
Over 65.0 to 75.0 inclusive	0.75	3.5	5.0	22	56.0	10.0	3.5	2
Over 75.0 to 85.0 inclusive	1.0	4.0	6.0	23	64.0	10.0	4.0	2
Over 85.0 to 100.0 inclusive	1.0	4.0	6.0	24	72.0	10.0	4.0	2
Over 100.0 to 115.0 inclusive	1.25	4.0	6.0	25	85.0	10.0	4.0	2
Over 115.0 to 125.0 inclusive	1.25	5.0	7.0	25	100.0	10.0	5.0	2
Over 125.0 to 135.0 inclusive	1.5	5.0	7.0	24	100.0	11.0	5.0	2
Over 135.0 to 150.0 inclusive	1.5	5.0	7.0	22	115.0	11.0	5.0	2
Over 150.0 to 175.0 inclusive	2.0	5.0	7.0	23	130.0	11.0	5.0	2
Over 175.0 to 200.0 inclusive	2.0	5.0	8.0	23	150.0	11.0	5.0	2
Over 200.0 to 250.0 inclusive	2.5	5.0	8.0	22	180.0	12.0	5.0	2
Over 250.0 to 300.0 inclusive	3.0	6.0	9.0	21	220.0	12.0	6.0	2
Over 300.0 to 350.0 inclusive	3.5	7.0	10.0	20	260.0	13.0	7.0	2
Over 350.0 to 400.0 inclusive	4.0	8.0	12.0	19	300.0	13.0	8.0	2
Over 400.0 to 450.0 inclusive	4.5	9.0	14.0	18	340.0	13.0	9.0	2
Over 450.0 to 500.0 inclusive	5.0	10.0	15.0	17	380.0	14.0	10.0	2
Over 500.0 to 550.0 inclusive	5.5	11.0	16.0	16	420.0	14.0	11.0	2
Over 550.0	6.0	12.0	18.0	15	460.0	14.0	12.0	2
<i>Welded joints of the II category</i>								
Over 1.0 to 1.5 inclusive	0.1	0.3	0.4	11	0.4	4.0	0.3	1
Over 1.5 to 2.0 inclusive	0.1	0.4	0.6	11	0.6	4.0	0.4	1
Over 2.0 to 2.5 inclusive	0.1	0.5	0.8	11	1.2	4.0	0.5	1
Over 2.5 to 3.5 inclusive	0.1	0.6	1.0	11	1.7	4.0	0.6	1
Over 3.5 to 5.0 inclusive	0.2	0.8	1.2	11	3.0	4.0	0.8	1

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2.2.7 UT FOR NIEP ERECTION PACKAGE WORKS

CONTENTS

S.No	Description
1	Scope
2	Application
3	Applicable documents and Standards
4	Personnel Qualifications
5	Instrumentation
5.1	Equipment
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6	Surface Preparation
7	Couplant
8	General Instructions
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9.3	Certification of Reference Blocks
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Annexure I	References.
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1. Scope

This Specification describes the requirements for Ultrasonic Testing (UT), by Pulse Echo Contact method by manual scanning of pressure retaining weld joints in steel piping of 5.5 mm to 400 mm thickness and cladding during construction of KKNPP.

2. Application

This Specification is applicable for all the systems of KKNPP during construction and pre-service examination of welds of equipments and piping of KKNPP. The scope and extent of inspection shall be as per working documents. This is a general specification, which shall be followed. Based on this specification, the contractor shall prepare the detailed procedure and get it approved by KKNPP. However any special requirements in the working documents shall be covered in separate procedures.

3. Applicable Documents and Standards Refer Annexure – I for references.

4. Personnel Qualifications

Scanning should be carried out by personnel qualified to UT Level II or Level I (ISNT). Verification of calibration, scanning, analysis of indications and reporting shall be by personnel qualified to UT Level II (ISNT). However, theoretical and practical capability of the personnel performing UT shall be checked periodically by KKNPP at site. The procedure shall be approved by person with Level III certification (ASNT/ISNT).

5. Instrumentation

5.1 Equipment

A Standard Ultrasonic Flaw Detector operating on the pulse-echo method capable of generating frequencies of 1 MHz to 5 MHz and satisfying the requirements mentioned below shall be used. (Performance characteristic verification of instrument and) verification system shall be done at every 3 months.

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Screen height Linearity

The Flaw Detector Instrument shall provide linear vertical presentation within $\pm 5\%$ of full screen height for 20% to 80% of calibrated screen height.

Amplitude Control Linearity

The Flaw detector Instrument shall utilize an amplitude control accurate over its useful range to $\pm 20\%$ of nominal amplitude ratio, to allow measurement of indications beyond the linear range of vertical display on screen.

The flaw detector instrument shall be checked for accuracy of measurement of distance by height reference blocks. The error shall be $\leq 2.5\%$ at distance of 50 mm and more.

Microprocessor based instruments with conventional Cathode Ray Tube (CRT) based display may also be used. The flaw detector shall be equipped with amplifier/attenuator with scale division of not more than 2 dB and range of at least 80 dB.

List below gives some standard make/model of UT flaw detectors commonly used.

Sonic USA - FTS MKI & MK IV

Crautkramer, Germany – USK 7, USIP-11, USIP-12, USM-2, USM-2M, USD-30 & USL48M

EEC, India - ESM-2, ESM-2M, EX-10, EX-100, Echoscan

Sonajest, Germany -

Note: Any other make and model with specific concurrence of BHEL & NPCIL can be used.

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5.2 Search Units

The Table-I & II give combination of search units/Inclined Transducers (IT)/ Piezoelectric Transducers (PZT) that are recommended for use with different thicknesses.

The frequency of vibration radiated from inclined transducer shall not differ from rated value by more than 10%.

The beam entry angle and transducer movement shall be selected in such a way as to make it possible to examine the weld by direct or direct/primary reflected beams.

Probes with matching curved shoes are recommended for piping below 50 mm diameter. With pipe dia 250 NB and below extra care shall be taken for making proper contact of the probe with surface being examined.

6. Surface Preparation:

The contact surfaces shall be free from dirt, dust, scale, weld spatter, roughness or other conditions like paint, oil spots which interfere with free movement of search unit or which can impair the transmission of ultrasound in the job. Examination shall be conducted on welds and adjacent base material in their completed surface condition.

The surface of welded joints on both sides in the zones of probe movement shall be cleaned from dust, dirt, scales, dents and other irregularities. The surface shall be having surface finish of 6.3 micron and waviness of surface shall not exceed 0.015 mm.

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7. Couplant

Oil, grease, glycerine, water or cellulose paste may be used as couplant. It must have sufficient wettability, viscosity and must be transparent to ultrasound. It must be harmless to skin and easily removable.

8. General Instructions

- 8.1 Ultrasonic examination shall be conducted after correcting the defects detected at visual and measuring inspection & LPT/MPE as the case may be.
- 8.2 Final acceptance of UT shall be conducted after final heat treatment, cladding and machining if they are the part of process. However intermediary examination may be required to ensure final acceptable welds.
- 8.3 Inaccessible areas for examination shall be marked in the Technique Sheet and agreed by KKNPP. When required, the weld reinforcement may have to be ground to provide adequate coverage. Such recording should be made in the Technique Sheet.
- 8.4 When voltage fluctuations interfere with UT examination, stabilizer shall be used. The equipment shall have back up battery.
- 8.5 The examination shall be carried out in horizontal or vertical position. Examination in overhead position shall be avoided.
- 8.6 No examination shall be planned during 12 midnight up to 6 AM. The lighting should be such that it does not hamper observation of screen.
- 8.7 The equipment, cables, probes shall be maintained and kept in workable condition. No loose connections, broken cables are permitted. Connecting sockets shall be cleaned regularly of grease and oil. Batteries shall be maintained in charged conditions and spares made available.
- 8.8 The joint numbers shall be engraved/ punched and verified before taking up any inspection. Each joint shall be divided in to sectors and marked by a standard method.
- 8.9 Based on this specification and working documents detailed UT procedure shall be prepared specific to each job.

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The procedure should address but not limited to the following variables:

- a) Characteristics of transducer [Piezoelectric Transducer (PZT)]
- b) Flaw detector and its response to probe
- c) Dead zone
- d) Beam exit point
- e) Angle of beam entry
- f) Distance and front resolution
- g) Pulse duration
- h) Distance measurement error
- i) Reference Block Test Sensitivity

The Technique Sheet (Control Sheet) for each type, size of joints shall be prepared. It shall be approved by engineer with Level III certification in UT.

Technique Sheet (the control chart) shall contain information about category of object under inspection (control), degree of accessibility, diagram and direction of test, scanning parameters, method of adjustment of sweep and sensitivity, attenuation, radius of curvature, sensitivity requirement and equivalent area of maximum permissible discontinuity, number of discontinuities permitted in 100mm etc.

- 8.10 The scope of inspection by Ultrasonic Examination shall be as per working documentation and corresponding inspection regulation.
- 8.11 When Ultrasonic Examination of joints is not practically possible the same may be replaced by visual and capillary/magnetic powder inspection (layer by layer) in consultation with KKNPP.
- 8.12 Weld Examination of austenitic Stainless-steel pipes and examination of anticorrosion cladding (surfacing) fillet welds require special ultrasonic examination procedures.
- 8.13 Ultrasonic examination evaluation using DGS diagram may be carried out after submission and approval of procedure by BHEL & NPCIL.

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- 8.14 When welded joints with higher thickness are examined attenuation shall be taken into account.
- 8.15 When examining the pipe welded joints using once reflected beam, it is necessary to take into account the loss of energy on internal cylindrical surface as per PNAE-G – 7 – 30 – 91 Part-II.

9. Calibration Block: (Standard Sample referred as “SS” or “CO” and Standard Sample of Factory referred as “SSF” or “COP”)

9.1 Standard Samples (SS)

These are Standard Reference Blocks. Reference Blocks of International Welding Institute conforming to VI (DIN54120) or V2 (54122) can be used. For calibration of TR probe, step wedge can be used.

9.2 Standard Samples Factory (SSF)

These calibration blocks are made for specific job and purpose See Fig.1 for Sample “SSF”.

- 9.2.1 Blocks shall be made of material with same acoustic properties and have same surface roughness as the item under testing. They shall not contain defects as examined by any NDT methods. Following difference in properties between the Reference Block and item under inspection are permitted.

By the speed of sound	: $\pm 5\%$
By acoustic impedance	: $\pm 5\%$
By damping factor	: $\pm 20\%$
By surface roughness	: 2.5 microns
By back wall signal at equal thickness	: 4 dB

Reference Blocks shall be of sufficient size to ensure absence of influence from side walls on defect echo signal.

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9.2.2 The calibration block shall be of the same product form and material specification or the equivalent material. For calibration blocks for dissimilar metal welds, the material selection shall be based on the side of the weld from which the examination will be conducted. Where two or more material thicknesses are involved, the calibration block shall be determined by the average thickness of the weld.

The calibration block shall preferably receive the same type of heat-treatment as the material specification.

9.2.3 Following tolerances are specified for the SSF.

- i) $\pm 0^{\circ}30'$ for angle between flat bottom hole and acoustic axis of the transducer.
- ii) $-0.2, +0.05$ mm for width and height of reflector.
- iii) $\pm 2.0^{\circ}$ for angle between the reflecting flat of the angular reflector and the sample surface.

9.2.4 For examination in materials where the examination diameter is more than 500 mm, a block of essentially the same curvature or alternatively a flat basic calibration block shall be used. When carrying out testing of cylindrical articles of radius less than 250 mm on the convex surface and of less than 500 mm on concave surface the radius of reference block R_{ref} shall satisfy following:

$$0.9 R_{art} \leq R_{ref} \leq 1.2 R_{art}$$

When R_{art} is radius of article under test.

9.3 Certification of Reference Blocks:

Standard Samples & Standard Factory Samples shall be checked, tested and certified by Level-III person in UT. For these blocks sketches showing dimensional details of material shall be made available. Each block shall bear distinctive identification number and Register of blocks available with contractor with date of certification.

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10. Calibration

10.1 Sensitivity Calibration

Distance (Sweep range) and Distance Amplitude calibration shall be made on SSF as per working document and inspection regulation for calibration using the reference blocks (SSF) following levels of sensitivity are specified for amplitude calibration.

- a) Sorting Level: Permissibility of detected discontinuity is evaluated at this level by the echo signal amplitude. For this maximum permissible equivalent area are specified in control regulation.
- b) Control Level: Characteristics of detected discontinuities are measured and their permissibility is evaluated by conventional height, width & length of defect. For determining sizes of discontinuities probe is moved until indication drops by 6 dB. This means that control level is 6 dB below sorting level.
- c) Searching Level: This is 6 dB above sorting level. This is same as "Scanning gain".
- d) Reference Level: Reference level at which echo signal from reflector in SSF has pre set height say (50%) on flaw detector screen.

10.2 Straight Beam Calibration

10.2.1 Sweep Range Calibration shall be done in such a way that greatest part of sweep on screen correspond to beam path in the welded joint under test.

10.2.2 Distance Amplitude Curve: This shall be plotted using reference block (SSF) at minimum of 3 metal distances using FBH (Flat Bottom Hole) as per fig. 1 'a'.

10.3 Angle beam calibration

10.3.1 Sweep Range Calibration shall be done in such a way that greatest part of sweep on screen correspond to beam path in the welded joint under test.

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10.3.2 Distance Amplitude Curve: This shall be plotted using reference block (SSF) at minimum of 3 metal distances using FBH as per fig. 1 'c'.

By directing beam on flat bottom reflector of known area S_{sam} (2 mm dia.) adjust indication height say 50% of screen height. Gain dB is noted down say "x" which is Reference level. If Control regulation permits maximum defect area as S_{st} , then sensitivity correction to be applied to get sorting level is

$$\Delta A = 20 \log \left[\frac{S_{st}}{S_{sam}} \right], \Delta A \text{ shall be less than 12 db.}$$

Searching level (scanning level) shall be +6dB from sorting level.

Control level for sizing of defect will be sorting level – 6 dB.

When maximum discontinuity permitted by control regulation and area of flat bottom hole in standard sample of factory (SSF) are same. $A = 0$ and Reference level and sorting level are same and can be called as "Calibration gain".

Calibration using side drilled holes as per references PNAEG – 7 – 30 – 91 Part-II are also acceptable.

10.4 Recalibration

10.4.1 Calibration check on basic calibration block (SSF) shall be made when any part of examination system (including personnel) is changed or in the beginning/end of shift or work/every 4 hrs. or less but more than one hour, to verify points on sweep and DAC values satisfy the original setting.

10.4.2 If a point on DAC curve has moved on the sweep line more than 10% of the sweep reading, or 5% of full sweep whichever is greater, correct the sweep range calibration and note the correction in the examination record. If reflectors are

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recorded on the data sheets, those sheets shall be voided and new calibration shall be recorded. All recorded indications since the last valid calibration shall be re-examined with the corrected calibration and their values shall be changed on data sheets.

10.4.3 If a point on DAC curve has decreased 20% or 2 dB of its amplitude, all data sheets since the last calibration/calibration check shall be marked void. A new calibration shall be made and recorded. The area covered by invalid data, shall be re-examined. If any point on DAC curve has increased more than 20% or 2 dB of its amplitude, all recorded indications since the last valid calibration, shall be re-examined with the corrected calibration and their values shall be changed on the data sheets.

11. Scanning

- 11.1 The entire volume of the weld and heat affected zone shall be covered by manual scanning and visual monitoring with 10% overlap of transducer dimension perpendicular to direction of scan.
- 11.2 The rate of search unit movement for examination shall not exceed 150 mm per second.
- 11.3 The normal beam scanning of the base material adjacent to the weld region shall be carried out to detect reflectors that might affect interpretation of angle beam results and is not to be used as an acceptance/rejection examination. Location of such reflectors shall be recorded.
- 11.4 When specified, weld and base metal shall be scanned up to a distance of 3T on both side of weld, where T is thickness of thicker plate with the straight beam search unit. The scanning shall be done at primary reference level + 6 dB

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(searching level). Evaluation shall be done at PRL (Sorting level). For this weld bead shall be ground smooth.

11.5 Scanning shall be done with angle beam directed at approximately right angle to the weld axis from two directions. The search unit shall be manipulated so as to maximize the response from the possible defect. When required Scanning shall be done with a set of two probe combination to ensure proper evaluation of the indication detected.

11.6 While scanning cylindrical items curvature shall be taken into account. Butt joints with thickness > 60 mm shall be scanned by direct beam as per Fig.2 "a" where possible.

Butt joints with thickness < 60 mm and circular welds of pipe lines and vessels with internal diameter of < 800 mm can be scanned as per fig.2 "b".

But joints with reinforcement removed shall be additionally examined by straight beam probe selected as per "Table-III".

For Stainless Steel clad pipes scanning shall be done by two angle (45 & 65) reflected beam should be avoided. It is preferable to do UT of weld before cladding as well as after cladding.

11.7 Tee joint welds in which thickness of item welded is over 60 mm scanning shall be done as per Fig.2 'c'.

Tee joint welds for thickness upto 60 mm can be scanned as per Fig. 2 'd' using reflected beam.

11.8 Butt & Tee weld joints with reinforcement removed shall be examined along the weld & HAZ. The probe shall be swiveled by 10 degrees as shown in Fig.3 'a'.

For welds with reinforcement scanning shall be on the side of the weld as shown in fig 3 'b'.

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- 11.9 If height of echo signal is below 20% of sorting level scanning is continued. If echo height is equal to or exceeding 20% sorting level characteristics of discontinuity are measured and recorded. Indications above sorting level are unacceptable.

12. Evaluation & Recording

Any imperfection which causes an indication in excess of 20% of DAC shall be recorded with respect to location, response level, dimension, depth below the reference, surface and physically marked. Record indication in a report format (annexure-II) and investigated to the extent that it can be evaluated in terms of relevant acceptance standard. If any repair is to be carried out, it shall be done as per relevant procedure. Removal of defect shall be ensured by capillary control. Whenever possible the removal shall be ensured by Ultrasonic examination. Re-examination of the repaired area shall be done as per the same procedure as used for the original detection of defect. The repaired area shall be marked "R1", "R2", etc.

13. Acceptance Standard

- 13.1 Indication characterized as crack, lack of fusion or incomplete penetration, are unacceptable regardless of length.
- 13.2 Other imperfections are unacceptable if their size, numbers, etc. exceed the limits specified in respective inspection regulation and working documents. Typical acceptance standard for PNAE-G-7-10-89 for pipelines of nuclear power plants (welded joints and cladding) is given in Table IV, V & VI. These acceptance standards are based on equivalent areas of individual discontinuities and numbers permitted.

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14. Post Examination and Cleaning

After the examination the test surface shall be thoroughly cleaned free from grease, oil, using dry cloth, and moistened cloth with acetone. The status of UT examination like UT examination “Satisfactory”, “Repair”, “Rejected”, shall be marked / tagged. The repair and Reject shall be intimated to concerned execution group for necessary action.

Repaired joint shall be monitored and re-examined by the same procedure for a final acceptance.

ANNEXURE I

REFERENCES

This document is based on the following:

1. GOST-14782-86 : Non-Destructive Testing, welded joints, ultrasonic methods
2. PNAE-G-007-30-91: Ultrasonic Testing Part-II – Unified Control Techniques of Part-II welded connections & cladding of Nuclear Power Unit equipment & pipe lines.
3. PNAE-G-7-32-91 Ultrasonic Testing-Austenitic Steel Welded Joints
4. PNAE-G-7-14-89 Ultrasonic Control of Basic Materials Part-I
5. PNAE-G-7-10-89 Equipments & Pipelines of Nuclear Power & Plants welded joints & weld surfacing inspection 2000 – R1 regulations.

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ANNEXURE-II

Ultrasonic Examination Report for Weld Joint

Report No.

Date:

Component Detail:

Joint No.:

Weld Category:

Applicable Procedure No:

Applicable Technique Sheet No:

Control Specification:

Material of Pipe:

Dia of Pipe:

Thickness of Pipe:

Test Date:

Type of joint:

Probe	Make	Type	Frequency

Name of equipment :

Model:

Amplitude Calibration

Ref. Level dB:

Ref. Echo Height:

Sorting level dB:

Sorting Echo Height

Searching Level dB:

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Surface Condition:

Calibration Range

Couplant

Scanning Technique:

UT Examination:

Data Record of Observations (Enclose sketch)

Area which cannot be examined:

Percentage Examination

Indication Serial No.:

Indication Size:

Defect Depth from Surface:

Distance along Weld from Lo:

Maximum Indication amplitude (% of DAC):

Type of Defect Indication:

Distance between Defects (min.):

Number of Defects for Specified Length of weld (Max. in worst location):

Remarks: Acceptable/Rejected/Repair

UT Examination done by:

Witnessed by:

Evaluated & Certified by:

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Selection of IT (Nominal Values)

Thickness of the welded joint mm	Frequency MHz	Input angle at control, deg.	
		By direct beam	By once reflected beam
From 5.5 to 9 inclusive	4-6	70+5	70+5
From 9 to 12 inclusive	4-6	65+5	65+5
From 12 to 20 inclusive	2.5-5	65+5	65+5
From 20 to 40 inclusive	2.5-4	65+5	45+5
From 40 to 60 inclusive	1.8-4	65+5	45+5
From 60 to 100 inclusive	1.8-2.5	60+5 ; 45+5	Not permissible
From 100 to 200 inclusive	1.25-2.25	60+5 ; 45+5	Same
Over 200	1.25-2.25	60+5 ; 45+5	Same

- Notes: 1. Welded joints with thickness of 60 mm are controlled by transducer with Input angle of 60-65° and more by direct beam only to the depth up to 60 mm.
2. For cladded welded joint with thickness from 20 to 60 mm PT with input angle of 45+50 is used additionally.
3. The control parameters in the control chart or US production process chart should be indicated clearly. It is not permissible to indicate the ranges of parameter values.
4. To increase the accessibility to control, it is permissible to use extra PTs and other control diagrams.

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Table-II

Selection of direct and SCT-transducers (nominal values)

Thickness of welded joint, mm	Type of transducer	Frequency, MHz
Upto 20 inclusive	Direct SC	4-6
Over 20 to 40 inclusive	Same	2.5-4.0
Over 40 to 60 inclusive	Same	1.8-4.0
Over 60	Direct combined	1.25-2.5

Table-III

Instructions on control for the transverse cracks

Type of welded joint	Scanning surface	Diameter of base element, mm	Thickness of base element, mm	Diagram of control
Butt joint: - without reinforcement - with reinforcement	Surface of the weld Base metal of near the weld zone	300 and more 800 and more	34 and more	Fig.3a Fig. 3b
Tee joint with reinforcement	Control from the side of base element (zone of the weld projection plus 10 mm)	800 and more	34-60	Fig.3a
Control from the side element to be welded (branch pipe)		800 and more ²	60 and more	Fig. 3b

1. In absence of access from the side of base element, examination is conducted from the side of element to be welded.
2. At diameter of element to be welded < 800 mm, examination for transverse defect is not conducted.

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Table-IV

Norms of Permissible Individual Discontinuities during Ultrasonic Inspection of Welded Joints of Steels of Pearlitic Class and/or High-Chromium Steels

Rated thickness of welded parts, mm	Equivalent area of individual discontinuity, mm ²						Permissible number of registered individual discontinuities per any 100 mm of welded joint length		
	Minimum registered			Maximum permissible					
	Category of welded joint			Category of welded joint			Category of welded joint		
	I	II	III	I	II	III	I	II	III
From 5.5 to 10, inclusive	2.0	2.5	3.5	4	5	7	4	5	7
From 10 to 20 inclusive	2.0	2.5	3.5	4	5	7	5	6	8
From 20 to 40, inclusive	2.0	2.5	3.5	4	5	7	6	7	9
From 40 to 60, inclusive	2.5	3.5	5.0	5	7	10	7	8	10
From 60 to 80, inclusive	3.5	5.0	7.5	7	10	15	7	9	11
From 80 to 100, inclusive	5.0	7.5	10.0	10	15	20	7	9	11
From 100 to 120, inclusive	5.0	7.5	10.0	10	15	20	8	10	12
From 120 to	7.5	10.0	15.0	15	20	30	8	10	12

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200, inclusive									
From 200 to 300, inclusive	15.0	20.0	25.0	30	40	50	9	11	13
From 300 to 400, inclusive	25.0			50			10		
From 400 to 600, inclusive	35.0			60			10		

Note: The norms of the equivalent area in the table are given with reference to inspection with the use of a standard flat-bottom reflector. It is permitted to use other kinds of reflectors provided the provisions of GOST 14782-86 with respect to the identify of inspection results are duly observed.

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Table-V

Norms of Permissible Individual Discontinuities in the Zone of fusion between Coated Metal and Base Metal during Inspection of Edges of Parts of Pearlitic Steel class of from High-Chromium Steel buttered with Austenitic Filler Materials.

Rated thickness of buttered edge, mm	Equivalent area of individual discontinuities, mm ²		Permissible number of registered individual discontinuities per any 100 mm of the length of buttered edge, pcs.		
	Minimum registered	Maximum permissible e	Category of welded joint		
			I	II	III
Over 10 to 40,	3.5	7 7 5	3	4	5
inclusive Over 40 to	3.5		4	5	6
60, inclusive	3.5		5	6	7
Over 60					

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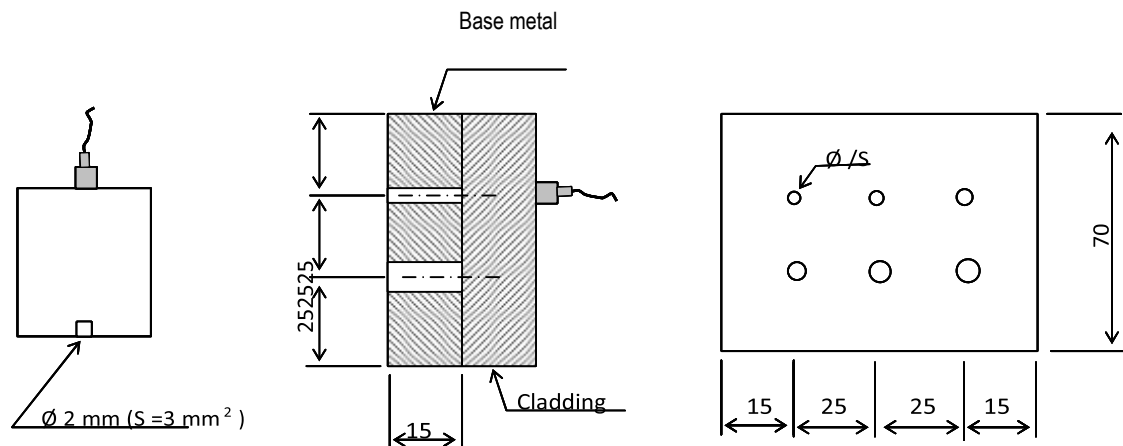
Table-VI

Norms of Permissible Individual Discontinuities in the Zone of fusion of the Built-up Metal with Base Metal during Inspection of Anticorrosive Weld Coating.

Rated thickness of weld coated part (article) without account of coating, mm	Equivalent area of individual discontinuities, mm ²		Permissible summary equivalent area of individual discontinuities on any section 200 x 200 mm ² in size
	Minimum registered	Maximum permissible	
Up to 100, inclusive	10	20 30	75
Over 100 to 300, inclusive	15	40	100
Over 300	20		125

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Standard Samples of factory (SSF) –Reference block



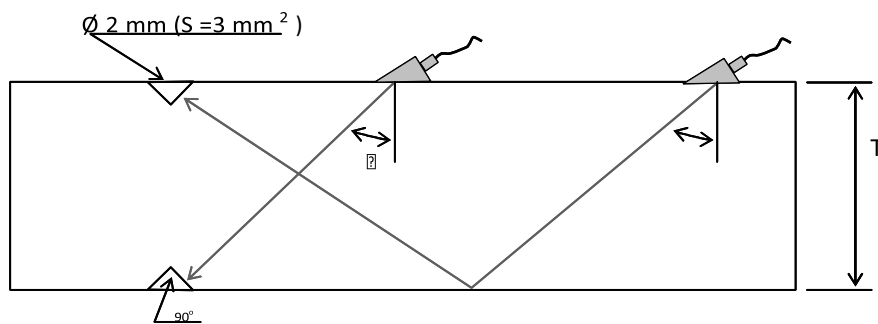
$\varnothing$ - Diameter

S - Area

All dimensions are in "mm"

Fig-1(a)

Fig-1(b)



□ - Probe angle

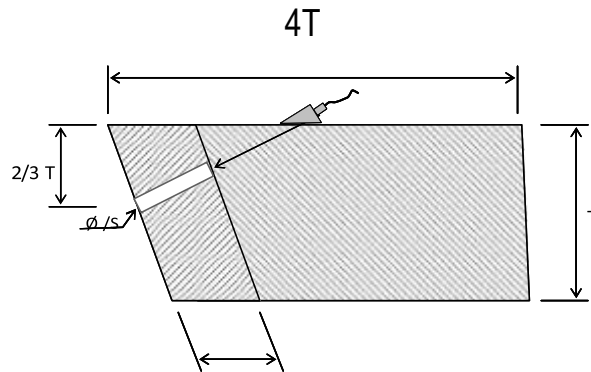
T -

Thickness of weld

Note – 1) For different angles & thickness different blocks are required 2) Other types of blocks with necessary corrections can be used

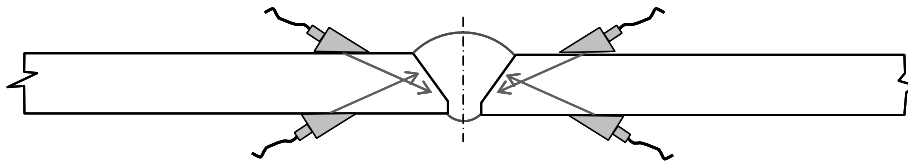
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Angle Beam (Weld Examination) – Fig-1(c)

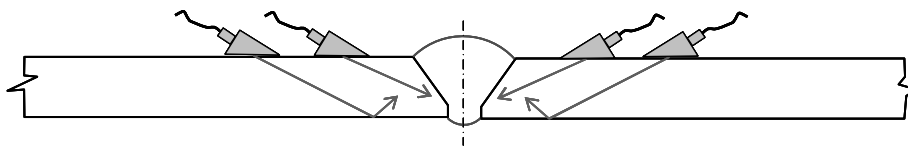


t – Thickness of
cladding

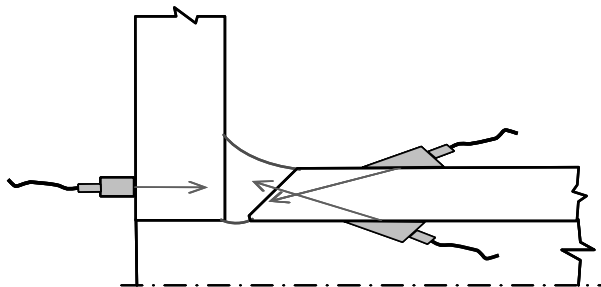
Angle Beam (Cladding Examination) – Fig-1(d)



Scanning Fig 2 (a)

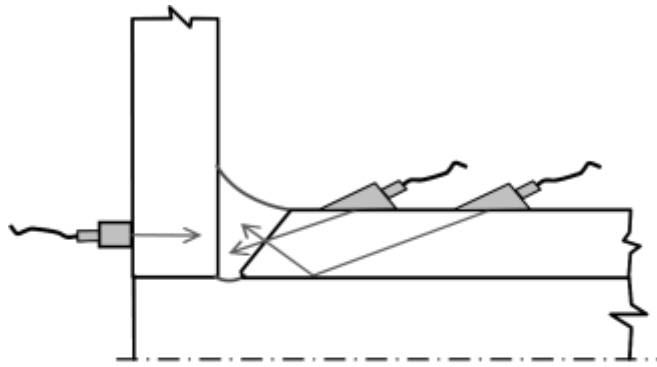


Scanning Fig 2 (b)

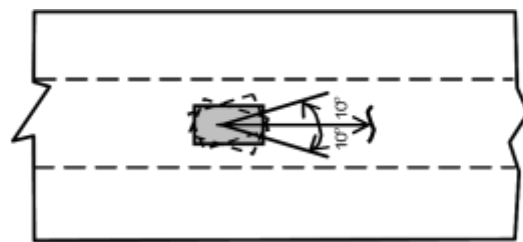


Scanning Fig 2 (c)

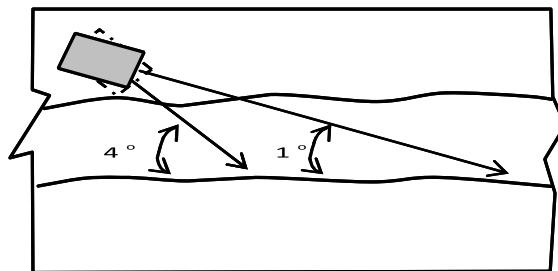
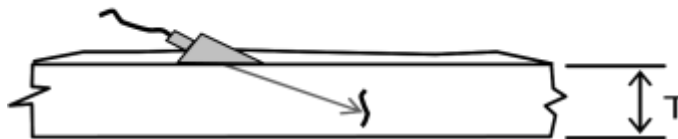
TECHNICAL CONDITIONS OF CONTRACT (TCC)



Scanning Fig 2 (d)



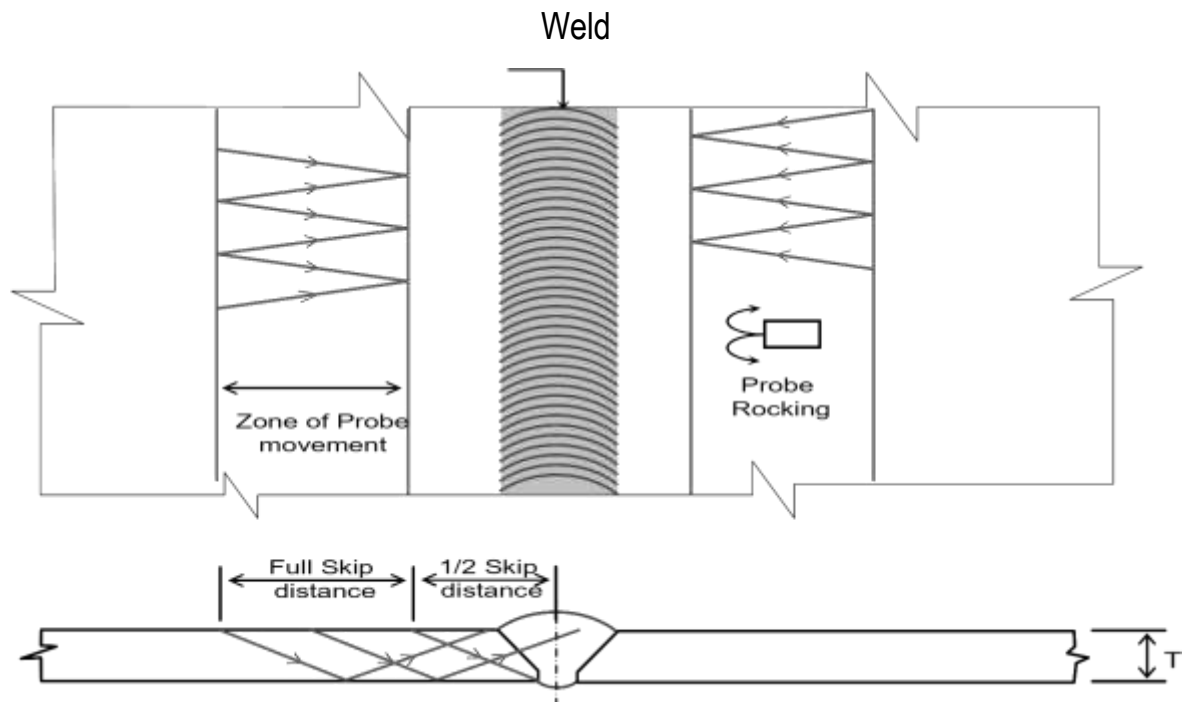
Scanning Fig 3 (a)



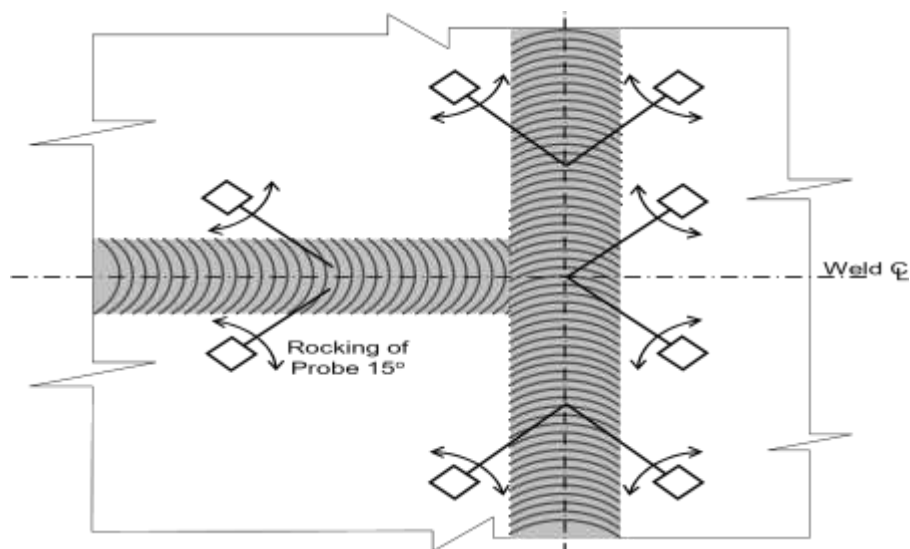
Scanning Fig 3 (b)

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1/2 skip scanning method



(a) Scanning for transverse cracks



(b) Scanning for weld intersection

Figure -04

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2.2.8 LPT FOR NIEP ERECTION PACKAGE WORKS

CONTENTS

S.No	Description
1	Scope
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3	Applicable documents and Standards
4	Personnel Qualification
5	PT Materials
6	Examination By LPT (Technique and sequence of operations
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6.2	Surface condition
6.3	Penetrant Application
6.4	Excess Penetrant Removal
6.5	Developer Application
6.6	Examination
7.0	Evaluation of Indications
8.0	Reporting of PT Results
9.0	Acceptance Standards
10.0	Repair of Defects and Re-examination
11.0	Post Cleaning
Annexures:	
Annexure I	References Documents
Annexure-II	Norms of Permissible Surface Inclusions in Welded Joint and Buttered edges

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LIQUID PENETRANT EXAMINATION:

1. SCOPE: This specification describes the method, technique and acceptance standard for the Liquid penetrant testing of welds of equipments, piping and base materials during construction of KK Nuclear power project.
2. APPLICATION: This specification is applicable for all the systems of KKNPP and to the surfaces as welded (cladded), clean, dry and free of scale, dust, rust etc. ground or machined having a temperature between 16° to 52°C. This is a general specification, which shall be followed. Based on this specification, the contractor shall prepare the detailed procedure and get it approved by KKNPP. However any special requirements in the working documents shall be covered in separate procedures.
3. APPLICABLE DOCUMENTS AND STANDARDS:
Refer list of documents enclosed as annexure- I (i.e References).
4. PERSONNEL QUALIFICATION:

The LPT shall be performed by personnel having minimum ISNT/ASNT (PT Level-I) qualification and for interpretation of the results Level-II qualified manpower (inspectors) shall be deployed. BHEL/NPCIL shall have the right to ask for requalification of any person who in his opinion is not performing satisfactorily. The PT procedures shall be approved by ISNT / ASNT Level - III qualified personnel.

5. PT MATERIALS:

Only NPCIL approved brands of PT materials (Cleaner, penetrant, developer etc.) shall be used for PT examination. The sulphur and halogen contents of the PT material shall not exceed 25ppm and the flash point shall be more than 60°.

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6. EXAMINATION BY LPT (Technique and sequence of operations):

The PT examination shall be conducted by visible red dye penetrant, solvent removable / water washable and non-aqueous wet developer method. If required other methods like fluorescent dye penetrant system may be used.

- 6.1 Illumination: The area to be examined shall have sufficient natural/artificial illumination. The lighting shall be minimum 350 Lux. The examination shall be carried out by placing the eye within 60 cms of the surface with angle not less than 30° to the surface under examination. Magnifying glasses with magnification around 7 can be used to assist examination.
- 6.2 Surface condition: Prior to PT examination, the surface shall be visually examined for freedom from cracks, peel off marks, pits, incomplete fusion, under cuts etc. The surface should be free from any dirt, grease, dust, scale, welding slag, weld spatter or any extraneous matter that may interfere with the test. Before PT, visual and measurement inspection of weld shall be completed. The surface shall be pre-cleaned with lint free cloth soaked in acetone or cleaner and then natural evaporation for drying of surface.
- 6.3 Penetrant Application: The penetrant shall be applied by Swabbing/brushing or spraying. The penetrant shall be allowed to remain on surface for a minimum of 10 minutes. It shall be ensured that the penetrant remains wet during the dwell time.
- 6.4 Excess Penetrant removal: On completion of penetrant time, the excess dye shall be removed by dry cloth followed by lightly soaked lint free cloth with cleaner. Precautions should be taken to avoid over cleaning to avoid sucking up of dye from discontinuities.
- 6.5 Developer application: Developer shall be applied by Aerosol can only (use of handpump is not permitted), immediately after the removal of excess penetrant. A uniform thin layer of developer shall be formed over the surface by keeping the aerosol can at a distance of 150 to 300mm and shall cover a length of about 300mm at a time.
- 6.6 Examination: Minimum of 7 minutes to Max. 20 minutes of development time shall be given and the job shall be observed at the time of application of developer so as to know the nature of the defect, which may develop out. As the developer dries to a smooth

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and even white coating, red indications will appear at the locations of the discontinuities due to bleeding out of the penetrant.

7. EVALUATION OF INDICATIONS:

The indications, as mechanical discontinuities at the surface will be indicated due to bleeding out of the penetrant. Indications of mechanical discontinuities are called relevant indications.

Localised surface imperfections, which may occur due to poor surface conditions, part geometry etc. are not relevant indications. All indications however shall be regarded as a defect, until the indication is either eliminated by surface conditioning or it is demonstrated to be non-relevant.

8. REPORTING OF RESULTS: Records shall be maintained in approved format for PT testing.

The LPT report shall contain but not limited to the following details-

- i) W.O Name/Number and date.
- ii) Equipment/component description.
- iii) Drg. No./Rev No. of the component.
- iv) LPT procedure No./date
- v) Material spec./weld category/weld identification etc.
- vi) Date and stage of inspection.
- vii) Applicable standard and sensitivity of inspection.
- viii) Surface conditions/temperature.
- ix) Make /brand of LPT materials with expiry date.
- x) Name/Qualification of the operator/examiner.
- xi) Acceptance standards.
- xii) Evaluation results/remarks.
- xiii) Signatures of accepting/approving authority.

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9. ACCEPTANCE STANDARDS: The acceptance standards shall be as per Working drawings and applicable standards. Acceptance standards as per Russian specification PNAE-G-007-10-89 (Table-7, Cl. 11.2) are given below as indicative.
- a) Indications of defects like cracks, non-fusion, incomplete penetration, undercuts as revealed by LPT are unacceptable.
 - b) Rounded indications below 0.6mm are acceptable regardless of thickness.
 - c) up to four indications of max. 3mm size rounded are acceptable in anticorrosive coatings in 100mmx100mm area.
 - d) Maximum Five inclusions (size max. 3mm) are acceptable in 25 sq. cm of weld overlays.
 - e) Refer Table (enclosed as annexure-II) for acceptance standards for different category of weld joints.
10. REPAIR OF DEFECTS AND RE EXAMINATION: Unacceptable defects shall be removed and re-examined to assure the complete removal of the defects. The defect shall be merged into the surrounding surface, if no further welding of the area is required. Completed repair area are also to be re-examined.
11. POST CLEANING: After the completion of the LPT, the examined area shall be cleaned thoroughly by dry cloth followed by moistened (with cleaner) cloth.

ANNEXURE - I

Reference documents:

- i) PNAE-G-007-018-89 : Unified control techniques of basic materials(Semi finished products) welded connections and claddings of Nuclear plant unit equipments and pipelines -Capillary control.
- ii) PNAE-G-007-010-89 : Equipments & Pipelines of Nuclear Power Plants welded joints & weld surfacing inspection regulations.

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ANNEXURE-II

Norms of Permissible Surface Inclusions in Welded Joint and Buttered Edges (For LP Examination)

Rated Thickness of welded (weld coated) parts, mm	Permissible maximum size of inclusion (Rounded/Elongated) in welded joints (weld surfacing) of categories, mm					Maximum permissible number of inclusions on any 100 mm of the length of welded joint (coating) of categories				
	I _H	II _H	I	II	III	I _H	II _H	I	II	III
Up to 2 inclusive	-	-	-	-	0.9	-	-	-	-	2
Over 2 to 3 inclusive	---	-	-	0.9	1.2	---	-	-	2	3
Over 3 to 4 inclusive	0.9	-	0.9	1.2	1.5	2 2 2	-	2	3	4
Over 4 to 5 inclusive	1.2	0.9	1.2	1.5	1.8	3 3 3	2	2	3	4
Over 5 to 6 inclusive	1.5	1.2	1.5	1.8	2.4	4	2	2	3	4
Over 6 to 8 inclusive	1.8	1.8	2.4	2.4	3.0	4 5	2	3	4	5
Over 8 to 10 inclusive	2.4	1.8	2.4	3.0	3.6		3	3	4	5
Over 10 to 15 inclusive	3.0	2.4	3.0	3.6	4.5		3	3	4	5
Over 15 to 20 inclusive	3.6	3.0	3.6	4.5	6.0		3	4	5	6
Over 20 to 40 inclusive	4.5	3.6	4.5	6.0	6.0		4	4	5	6
Over 40 to 100 inclusive	4.5	4.5	4.5	6.0	7.5		4	5	6	7
Over 100 to 200 inclusive		4.5	4.5	6.0	7.5		5	6	7	8
Over 200 inclusive		4.5	4.5	6.0	7.5		6	7	8	9

Notes. 1. Indication of Inclusions of maximum size up to 0.6 mm are disregarded irrespective of the rated thickness of welded (weld coated) parts both when counting the number of individual inclusions and when considering the distance between inclusions.

2. Any combination of inclusions (individual clusters, group of inclusions), which may be inscribed into a square with a side size not exceeding the maximum permissible size of an individual inclusion, may be considered as a single solid inclusion.

Note: i) This table has been reproduced from Table:7 of PNAE-G-7-10-89 with appropriate Multiplication by a factor 3.

ii. Weld joint category I, II, III, I_H & II_H are as per PNAE – G – 7 – 010 – 89 and details are also mentioned in Welding Specification.

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2.2.9 HANDLING, TESTING, ERECTION OF VALVES

CONTENTS

Sr No	Description
1	Purpose
2	Scope of work
3	General Description
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3.2	preservation of hand wheel
3.3	Testing of valves
3.4	Vent plug welding
3.5	Base plate welding
3.6	Protection of valve
3.7	Erection of valves
3.8	Check valves
3.9	Pneumatic operate valves
3.10.	Special valves:
3.10.1	FSIV (fast steam isolation valve)
3.10.2	Pulse safety device
4	Reports and Records:

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1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during handling, storage, testing and erection of valves covered under this contract.

2. Scope of work:

The scope of the contractor's work comprises but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures, Preparation of erection schemes.
- iii. Receipt of material from BHEL/NPCIL store, transportation, storage.
- iv. De-preservation of valves, welding of vent plug and base plate for supports as per drawings.
- v. Shifting and testing of valves at valve testing facility provided by BHEL.
- vi. Shifting the valves to the required location, erection and fit-up of valves as per drawings.
- vii. Inspection and preparation of reports.

3. General Description:

- i Various types of valves are mounted in the process systems piping such as Stop valves, check valves, control valves, throttle valves, safety relief valves, special valves such as pulse safety devices, fast steam isolation valves etc.
- ii Valves are operated by electrical actuators, manual operated valves, pulse safety valves, pneumatic operated valves, and solenoid operated valves, etc.
- iii Valve size ranges from 10NB to 600NB diameter and weight of valve is 0.5Kg to 6000kg.
- iv These valves need to be erected in various buildings, location, orientations and elevations.
- v The material of construction of the valve is of carbon steel or stainless steel.

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- vi Valves are required to be erected in horizontal pipeline, vertical pipelines or in any other orientation as per the requirement specified in the drawings.
- vii For general scope of work regarding material receipt, preservation, de-preservation, storage etc, refer general technical specification.

3.1. Spares and accessories:

Usually valves will be supplied along with spares, accessories and a few electrical /instrumentation items. Contractor shall draw only the material required for erection. Any spares/ accessories/electrical /instrumentation items which are included in the main package of the valve shall be identified, recorded & returned to BHEL/NPCIL stores immediately after receipt of material before finalizing the IMIR.

3.2. Preserving hand wheels:

Both electrical and manual operated valves are provided with hand wheels for manual operation. These hand wheels are to be removed and preserved by the contractor to avoid damage during erection and till commissioning as instructed by the engineer. The contractor's procedure shall address this aspect, including safe storage of hand wheels with proper identification for easy retrievability. Contractor's rate shall include this activity also.

3.3. Testing of valves:

- i. Valve testing facility shall be provided by BHEL.
- ii. For operation of valves testing machines, qualified & trained operators for round the clock operation as per agreed schedule shall be deployed including skilled and unskilled workers for handling at VTF.
- iii. Valves shall be tested well in advance before proceeding for erection at site.
- iv. Scope includes arrangement of calibrated pressure gauge of different range with least count and range shall be as per approved procedure / standards including regular calibration.

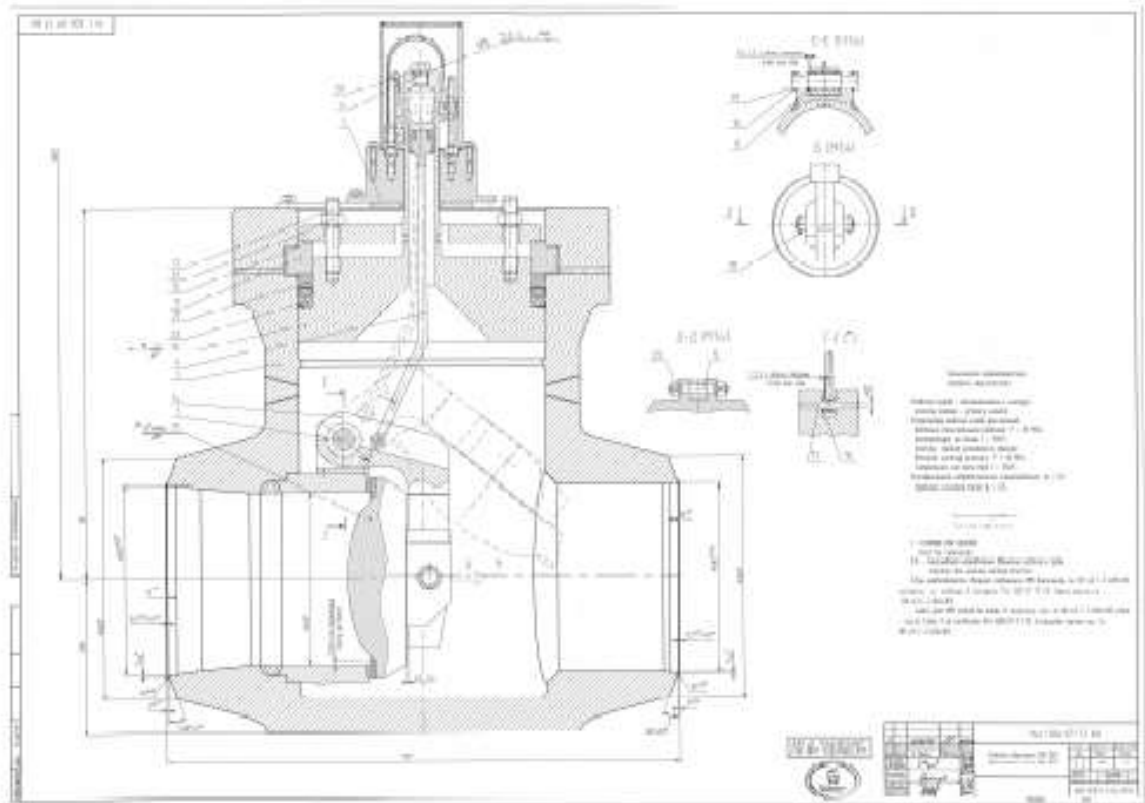
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- v. Shifting of valves from BHEL/NPCIL storage yard to the valve testing facility, configuring the machine to the required configuration by changing the sealing arrangements, pressure settings etc as per the valve testing machine manufacturer instruction, mounting the valves on the rig.
- vi. DM water required for testing of valves will be issued on free issue basis. However, NPCIL will provide the DM water at one point, collection and transportation to the required location shall be carried out by the contractor.
- vii. Valves shall be tested using medium as specified in drawings and manufacturer instruction.
- viii. The rate of pressurization, dwell time & rate of de-pressurization shall be maintained as per approved procedures.
- ix. Recording the readings through computer interface, generating the report, demounting the valve from the test rig.
- x. Valves to be tested may be of manual, electrical, pneumatic operated. It is the responsibility of contractor to make arrangement for opening and closing using electrical / pneumatic and also operate with trained & skilled persons. Air compressor and electrical power connection will be arranged if the VTF by BHEL/NPCIL.
- xi. Scope also includes testing, adjustment and calibration of the safety relief valves.
- xii. Tested valve shall be cleaned thoroughly from oil, grease, dirt & foreign material and ends shall be covered with the end caps as supplied. Shifting back the valves to the storage yard / erection site based on the requirement.
- xiii. Scope also includes arrangement of all the necessary manpower for operating the machines, setting of valve testing machines, generating the reports through computer interface etc. throughout the contract period.

3.4. Vent plug welding:

- i. Valves (both gate and check valves) are provided with vent plug which is used for venting during testing of valves at manufacturer's shop. These vent plugs are

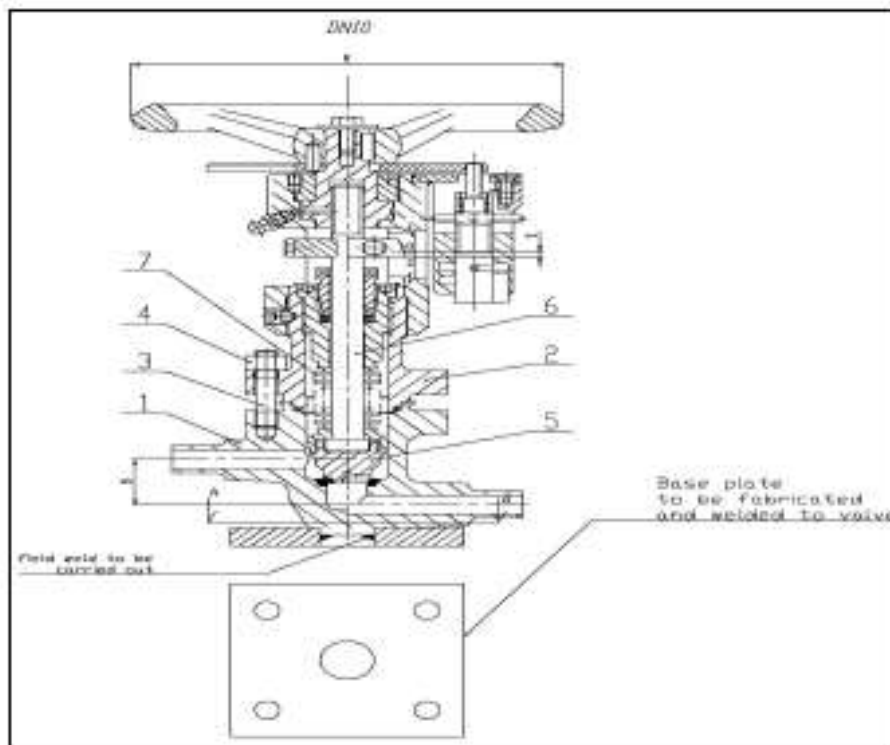
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3.5. Base plate welding:

- i. Small bore valves are provided with base projection but without base plate.
- ii. To facilitate the valve with supporting arrangement, base plates are to be welded at site. Base plate shall be same as the material of construction of the valve. i.e., stainless steel valves shall be provided with the SS plate and CS valves with the CS base plates.
- iii. Activities include taking the measurements, marking, cutting, drilling, grinding, fit up, welding and inspection etc. Fabrication of the base plate will be measured in the relevant BOQ item.
- iv. Typical arrangement of the base plate to be attached to the base of the valve is as shown in the above sketch.
- v. Care shall be taken during welding of the base plate with the valve bottom. Any excess heat may cause damage to the seat of the valve.

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3.6. Protection of valve:

- i. All the valve actuators, solenoids, pneumatic cylinders etc shall be protected from physical damage, water, fire etc.
- ii. To do so all these items shall be protected using protective covering with rubber fabric with silicon coat of required thickness.

For detailed scope for protection of valves refer general technical specification.

3.7. Erection of valves:

- i. Handling and shifting of the valves from the contractor's warehouse to the respective location.
- ii. Heavy, big bore valves shall be handled carefully. Slings of these valves shall be done as per the manufacturer instruction.
- iii. During shifting & erection valve ends shall be covered with plastic end caps. These caps shall be removed only just before fit up.
- iv. Valve may require to be erected in any orientation, elevation, in vertical/ horizontal pipelines. In case of big bore electrical operated valves, during shifting of valve to the location, there may be requirement to dismantle the electrical actuators for safe

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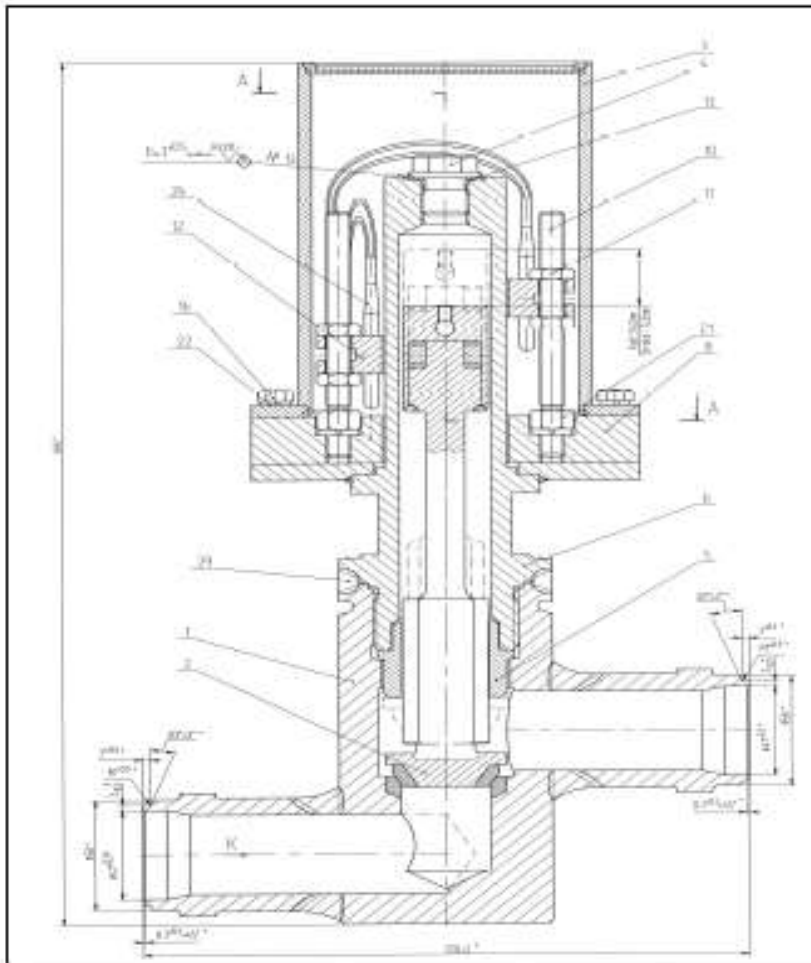
shifting of the valves. Contractor's Scope includes dismantling and reassembling of such actuators from the valves.

- v. While erection of the electrical operated valve, there may be a requirement for changing the orientation of the actuator. Scope includes changing of the actuator orientation to suit to site condition.
- vi. Jig & fixtures required for handling of valves shall be arranged by the contractor within the quoted rate and the same shall be dismantled and removed once its function is fulfilled.
- vii. Before fit-up of the valve, ensured that the preservatives are removed and cleaned.
- viii. In addition to the above scope of work, there are additional requirements based type of valves, such requirements are compiled and given below.

3.8. Check valves:

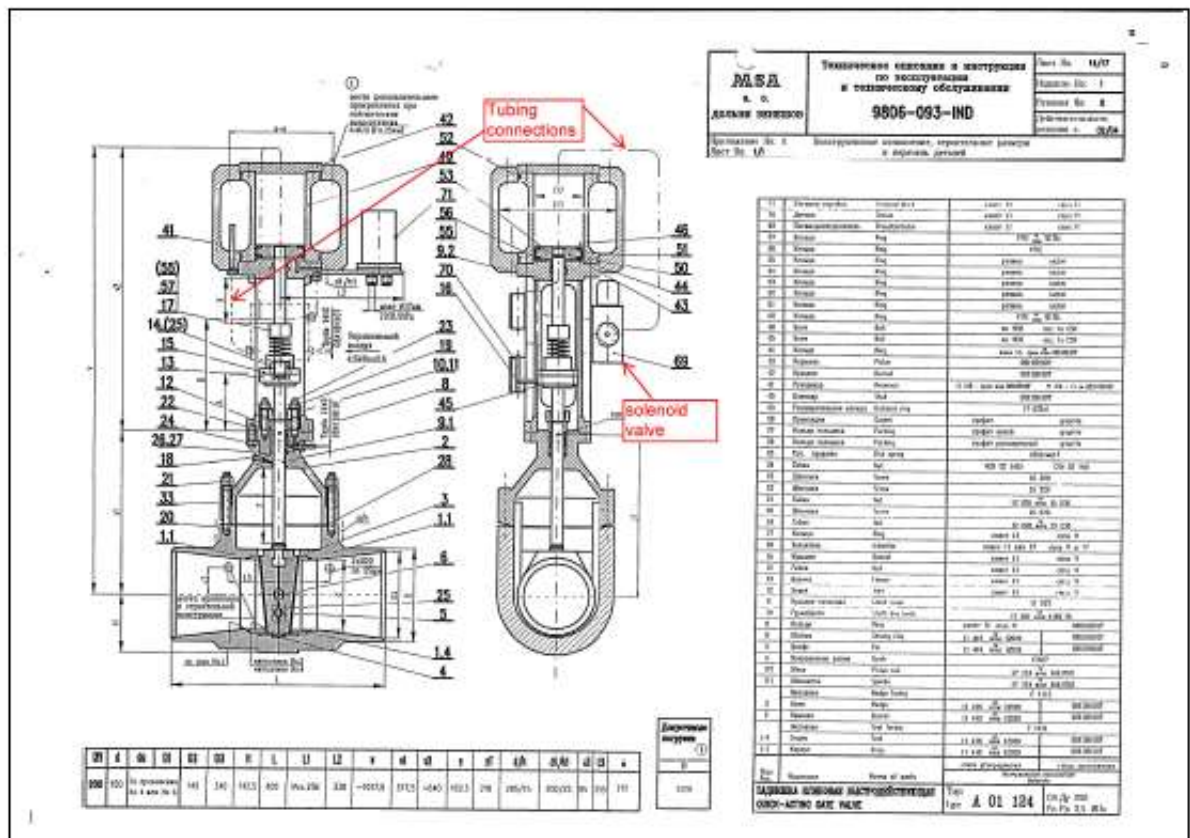
- i. Check valves also known as non return valves are direction oriented, i.e. these valves are to be erected as per the direction of the flow, If flow direction mark is missing and same shall be brought to the notice of BHEL.
- ii. Some of the check valve is provided with the position indicators. Contractor shall ensure healthiness of these position indicators before proceeding for fit up. Any deviation or deficiency found during the inspection stage, the same shall be reported to BHEL and shall be rectified as per the instruction of BHEL/NPCIL.
- iii. Typical sketch of the check valve is as shown below

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3.9. Pneumatic operate valves:



- i. Typical arrangement of pneumatic operated valves is as shown in the sketch above.
- ii. All the containment isolation valves, quick boron injection system valves are provided with pneumatic operated actuators.
- iii. These pneumatic operated valves typically consist of a pneumatic cylinder (double acting or single acting based on the function) and a piston connected to the valve stem. This piston is operated by means of solenoid valves.
- iv. Connections from the solenoid valves to the cylinder are done using a tubing network.
- v. All these valves are needed to be erected along with the piping and may not be required to be operated till commissioning.
- vi. To prevent any kind of damage to these valves, scope includes dismantling all these solenoids, connecting tubing work along with solenoid valve, preserving these items with proper identification and coding. For carrying out this job, qualified

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pipe fitter shall be involved in study of tube connections between the solenoid and the cylinder.

- vii. After dismantling the solenoid valves, the cylinder ports shall be closed using temporary threaded plugs.
- viii. For carrying out hydro testing of circuits/ containment testing etc., these valves are to be operated without power supply. Temporary arrangements with nitrogen cylinders and tubing shall be made for such temporary operation. Providing such temporary arrangements also is in the scope of contractor without any extra payment.
- ix. Re-fixing the solenoid valves and the connecting tubing shall be done as per the instruction of the engineer. Re-fixing of solenoid shall be carried out as per the original installation. Scope includes dismantling and re-fixing of these assemblies.

3.10. Special valves:

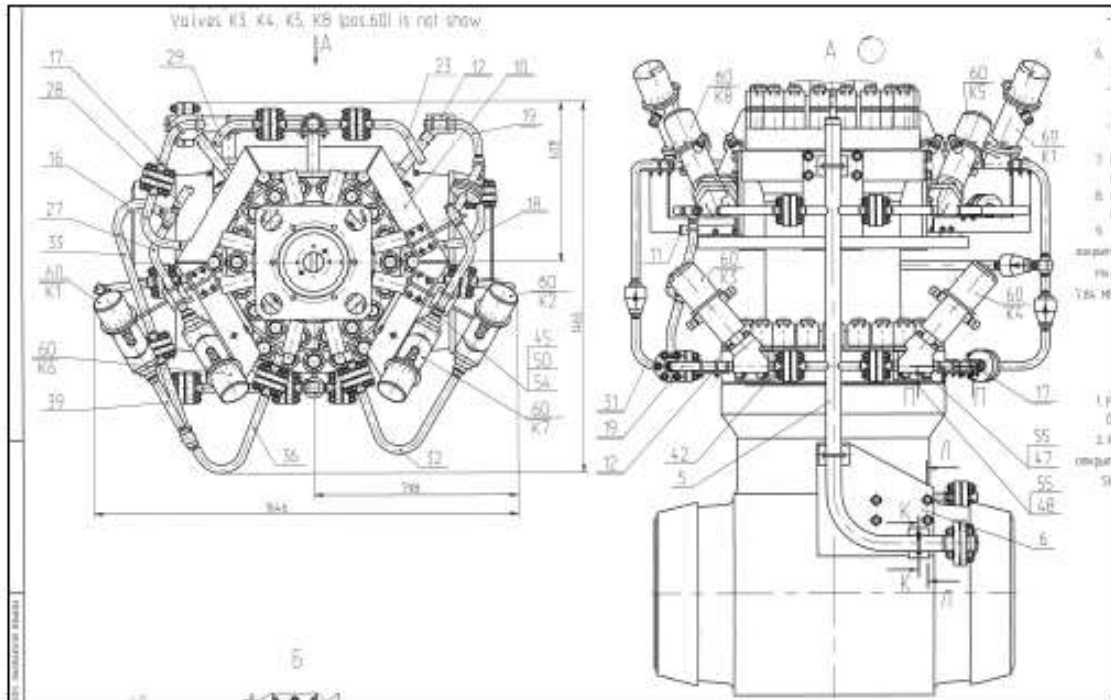
- i. Based on the mode of operation and construction of the valves, some of the valves are categorized as special valves such as Fast steam isolation valves (FSIV), Pulse safety device of steam line (SGPSD), pressurizer system emergency core cooling system stage-1 and fuel pool cooling system etc.
- ii. Even though their purpose of operation is to act as stop valve or safety relief valve their mode of operation and construction are completely different.
- iii. As mentioned above there are mainly two types of special valves such as fast steam isolation valve and pulse safety device.

3.10.1 FSIV (fast steam isolation valve):

- i. As name indicates the main purpose of this valve is to ensure fast closing and opening as per the process requirement. Total weight of each assembly is around 6MT.
- ii. The valves consist of valve body with actuator and interconnecting pipelines with series of solenoid operating valves and set of orifices.

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- iii. These valves will be supplied in assembled condition i.e. with complete interconnecting lines, valves and orifices. The arrangement of the FSIV is as shown.



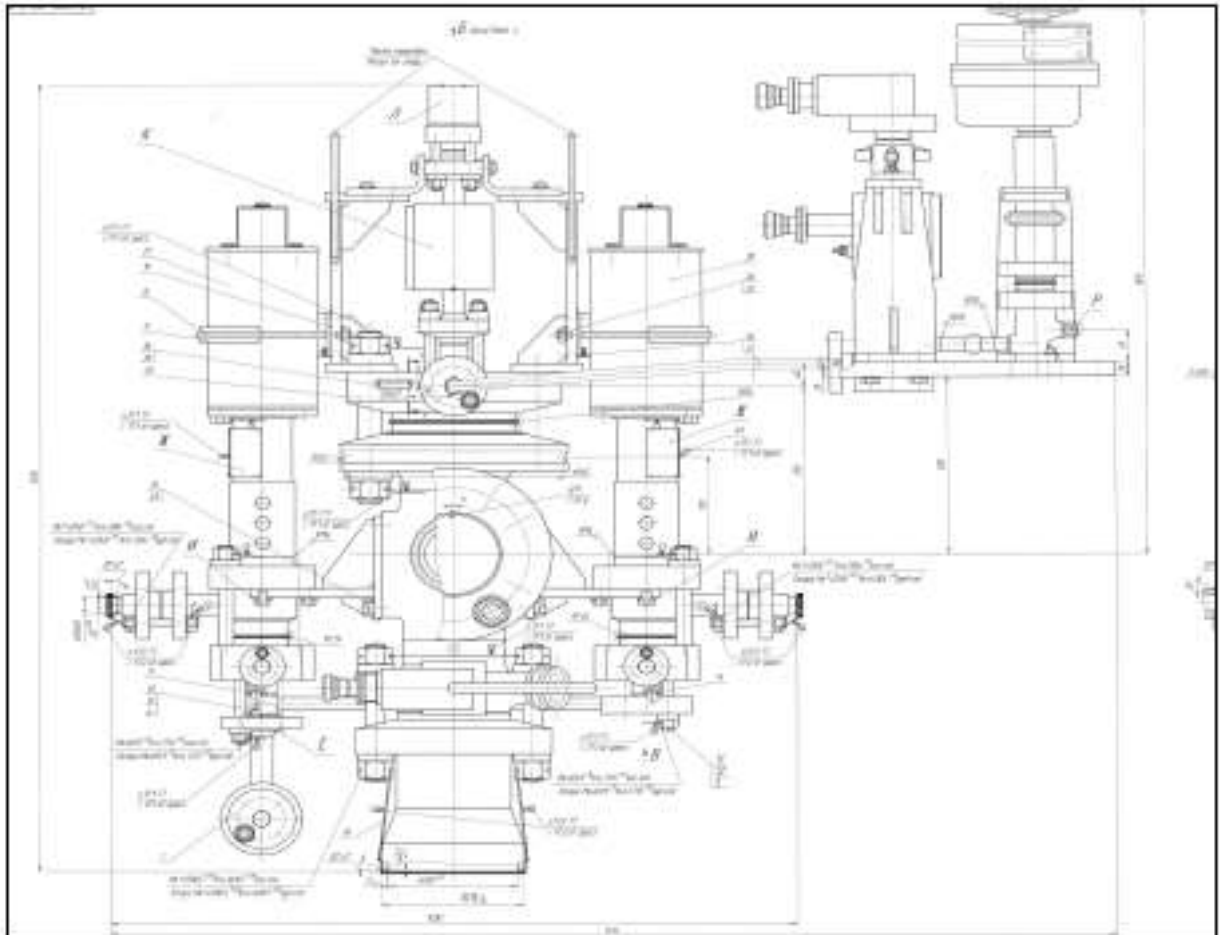
- iv. These valves are to be erected at +12.00m elevation inside UJE (steam chamber building). For shifting to the respective location, these valves are to be lifted top of the respective rooms of UJE before lowering to the required locations.
- v. All interconnecting piping and some of the accessories are to be removed before shifting the valves to location to facilitate easy handling as well as to avoid damage. Scope includes match marking of these interconnecting pipelines, dismantling the pipelines, safe guarding the check valves, orifices and gaskets.
- vi. Shifting the dismantled items to the contractor store, with proper identification marking.
- vii. Shifting the valve to the required location, erection and fit up, welding and inspection of valve.
- viii. Re-assembling and the connecting pipelines of FSIV.
- ix. Re-assembling of connecting pipelines as per the match markings made during the disassembly. Care shall be taken in placing the gaskets; no bending / tensioning of pipelines is permitted during re -assembling work.

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- x. During re-assembly of the connecting lines, checking has to be carried out to ensure thoroughness of connecting piping, intactness of the gaskets, placement of orifice, orifice orientation etc.
- xi. Any interference of the adjacent metal structure with the interconnecting pipelines during assembly needs a modification in the structure. Scope includes modification of such structure. Such modification of metal structure will be measured and paid in the relevant BOQ item.

3.10.2 Pulse safety device:

- i. Pulse safety device (PSD) is a safety valve for over pressure protection and is operated by means of solenoid as well as system pressure.
- ii. It mainly consists of main valve and one or two nos of pilot valves. Pilot valves will operate the main valve and pilot valves are operated by means of system pressure and solenoids.
- iii. Typical construction of pressurizer PSD is as shown below:



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- iv. Connection between the main valve and the pilot valves are made by means of flanged connections with metal gasket. PSD is supplied in single assembly.
- v. Some of these connections may need to be dismantled during erection, for fit up with main pipes and pilot pipes.
- vi. During dismantling of pipelines care shall be taken that the sealing lip of these connections, which are very thin and prone to damage. Utmost care shall be taken to prevent damage to the lip of the sealing element.
- vii. Also the gaskets supplied along with the valve are very unique, shall be preserved carefully during installation of the valve.

4. Reports and Records:

- i. Erection report, as built information shall be reported in the prescribed format in quality assurance plan.
- ii. Cleanliness report, de-preservation report, IMIR etc shall be prepared and submitted as per the prescribed format in quality assurance plan.

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2.2.10 SUPPLY, FABRICATION, ERECTION, WELDING, TESTING OF DRIVE MECHANISM FOR REMOTE DRIVE VALVES

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	Sequence of activities
3.1	General information
3.2	Supply of material
3.3	Erection of penetration Shell
3.4	Erection of Supporting and connecting members
4	Reports and Records

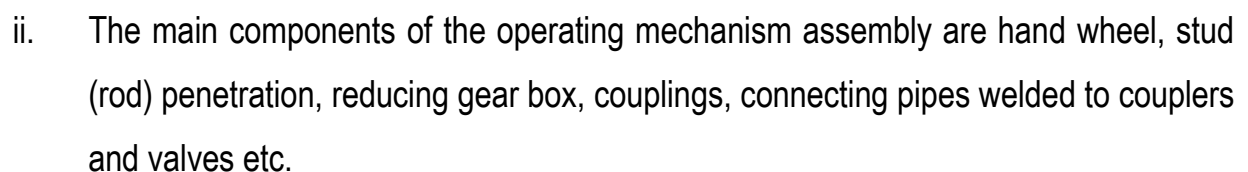
1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during fabrication, erection, welding and operation of the mechanism for the remote drive valves at various floors / location in reactor auxiliary building.

2. Scope:

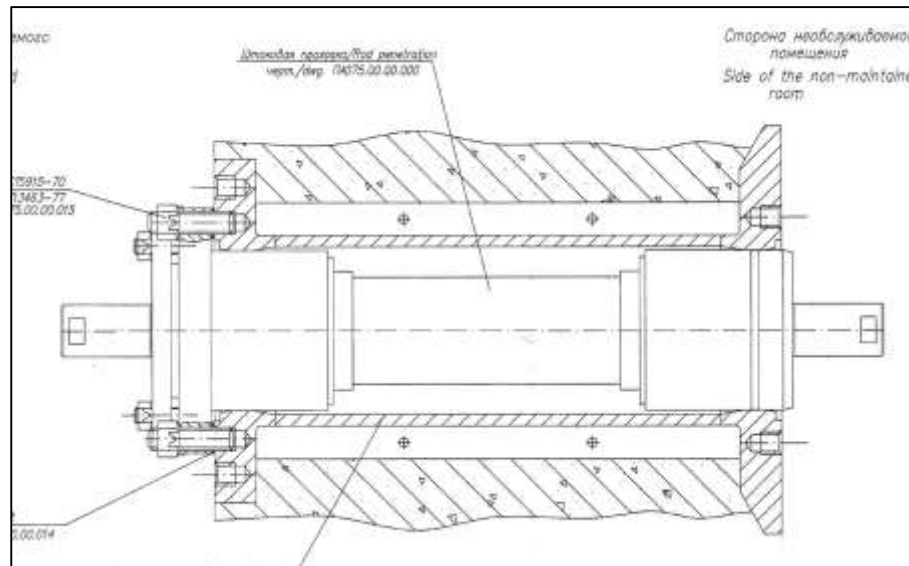
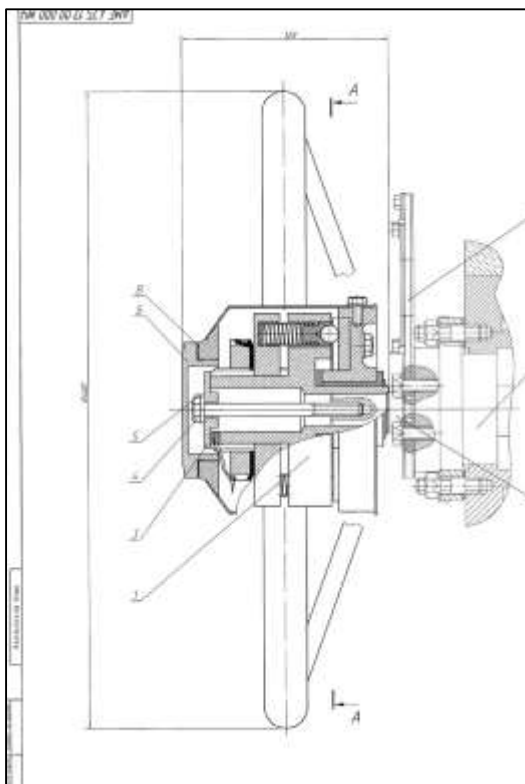
- i. Handling, transportation, receipt of free issue material, preparation of IMIR, depreservation, preparation of procedure and other general requirements and the scope of work refer Technical Specification-General.
- ii. Supply of pipe material as per IS 1239 with relevant test certificates, quantities based on the instruction of Engineer.

3. Sequence of activities:
- 3.1 General information:
- i. A typical arrangement of valves for remote operation is as shown below



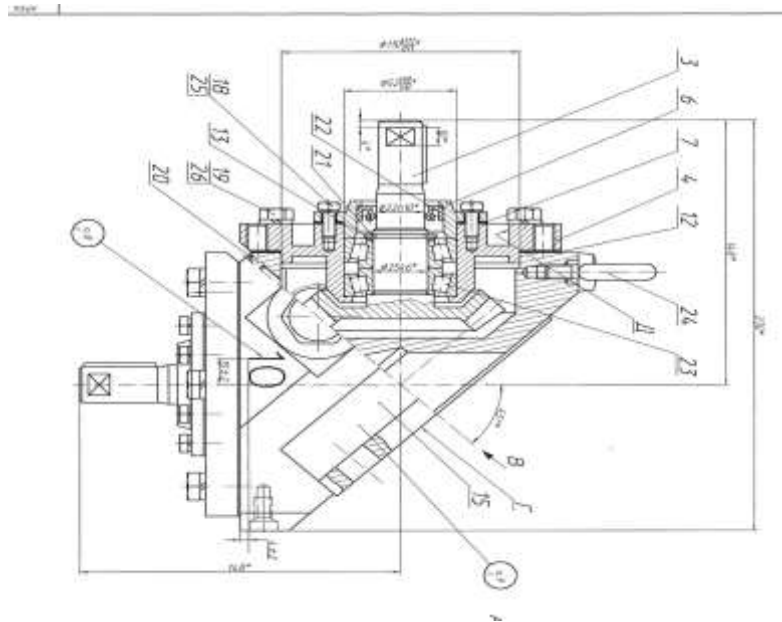
TECHNICAL CONDITIONS OF CONTRACT (TCC)

- iii. Payment for erection of valves is measured and paid in the relevant BOQ item of valve. The remote drive erection item includes supply of CS pipe of IS1239 Heavy grade, fabrication, welding with coupler, erection of links from hand wheel to valve, inspection and satisfactory hand operation of valves.
- iv. Hand wheel, penetration, links, coupler, gear box will be supplied as free issue material, where as the connecting link pipes shall be supplied by the contractor. i.e. supply of link pipe is under the scope of work.
- v. Typical hand wheel assembly & penetration shaft is as shown below



Reducing gear box as shown below, the main function of this gear box is to reduce number of rotations and change the direction of the spindle and transfer to the desired valve.

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3.2 Supply of raw material:

- i. Supply of pipe material for fabrication of the links to form the mechanism.
 - a) IS 1239-Heavy Grade, Outer Dia 42.9mm & Thickness 4.05 mm. - Approximate
 - a. Quantity -600meters
 - b) IS 1239-Heavy Grade, Outer Dia 48.8mm & Thickness 4.05 mm. -Qty -200 meters
- Scope also includes grit blasting, supply & application of zinc silicate primer and final epoxy painting.

3.3 Erection of penetration Shaft:

- i. Identification of embedded parts (EP), corresponding to valve location in Reactor Aux. building (UKC) with reference to working document.
- ii. Cleaning of EP before installation of remote drive assemblies.
- iii. Identification of respective remote drive elements such as rods, coupler, reduction gear, valve position indicator, hand wheel, nuts bolts, washer, gasket etc. for a specific valve as per document.
- iv. Placing the rod penetration in the specified EP as per document, fixing the same with bolts and nuts from outside the room.
- v. Assembly and installing the component like coupler, column, valve position indicator, reduction gear, and hand wheel on to the rod penetration.

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- vi. Tightening the rod penetration nuts/bolts to torque of 14Nm, or the value specified in the working document using calibrated torque wrench.
- vii. During assembly of the rod penetration with the embedded part care shall be taken to retain the gasket in position.
- viii. Carryout pneumatic pressure test of gap between the rod penetration and the embedded part. The scope includes arranging the testing equipments, temporary arrangements and carrying out the test. Leakage is not permitted. Unless otherwise specified, test shall be carried out at a pressure of 2Kg/cm².
- ix. Check operation and functioning of rod penetration with hand wheel before assembly of connecting members.

3.4 Erection of support and connecting members:

- i. Ensure the valve of process system is erected and accepted in correct position.
- ii. Take the field measurements from the valve to the penetration drive shaft.
- iii. Decide the positions of the gear box and preparation of the layout from the drive shaft to the valve showing number of links, position of the gear box, couplings, and measurements of the links.
- iv. Erection of the supports shall be carried out for gear box and the other members. Erection of supports may require mounting of hilti anchor fasteners. Before proceeding for the support erection, drawing shall be prepared prior to the physical work and concurrence from BHEL & NPCIL shall be obtained.
- v. Gear box erection shall be done over the supports erected using mechanical fasteners.
- vi. Based on the field measurements link members (i.e. pipe 42.9 x 4.05 as per IS 1239 Heavy Grade and pipe dia 48.8 x 4.05 as per IS 1239-Heavy grade) shall be marked and cut to the required length.
- vii. Welding of articulated hinges, couplings shall be carried out with the link pipes fabricated using GTAW / SMAW. Supply of welding consumables is also included in

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the scope of work. Welding also is included in the scope of work and will not be measured separately.

- viii. Assembly of welded links to the shaft assembly, gear box and the valve shall be carried out as per the preliminary layout made. (Note: links are to be connected using cottar pins, supply of cottar pins is included under the scope of work)
- ix. After installation of rod penetration, connection between rod penetration and valve to be made using pipes, articulated hinges adapter and support structures.
- x. Inspection shall be carried out as per the requirements given in the applicable working drawings. NDE carried will measured and paid under the relevant BOQ item.

4. Reports and records:

- i. As built reports shall be submitted for the completed valves with detailed dimensions and layout.
- ii. Records shall be submitted in the prescribed formats defined in the quality assurance plans

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2.2.11 ERECTION, WELDING AND DRILLING OF O-LET (BOSS) ON PIPE SPOOLS AT SHOP AND IN-SITU.

CONTENTS

Sr No	Description
1	Purpose
2	Scope
2.1	General Description
2.2	Mounting of O-let / Thermo Well Lug:
2.3	Welding and final drilling.
3	Reports & Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during erection of O-lets in various piping systems covered under this contract in various buildings at various locations and elevations.

2. Scope:

The contractor scope work involves but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.
- iii. Receipt of material from BHEL/NPCIL store, transportation, storage
- iv. Receipt of material , handling & preparation of IMIR ,
- v. Identification of pipe spools and O-lets,

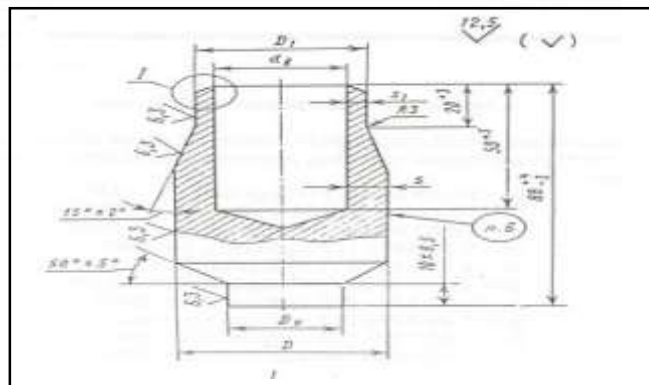
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- vi. Handling, shifting to contractor's shop and storage.
- vii. Marking position & orientation of O-let, pilot hole drilling, fit-up of O-let.
- viii. Welding using GTAW process for root & stabilizing passes and SMAW for balance pass welding.
- ix. Carrying out visual inspection and other NDE as per requirement.
- x. Carrying out final drilling of O-lets of various sizes ranging from 10NB to 150NB (NB is the branch pipe size connecting to O-let).
- xi. Carrying out visual inspection and other NDE as per requirement.

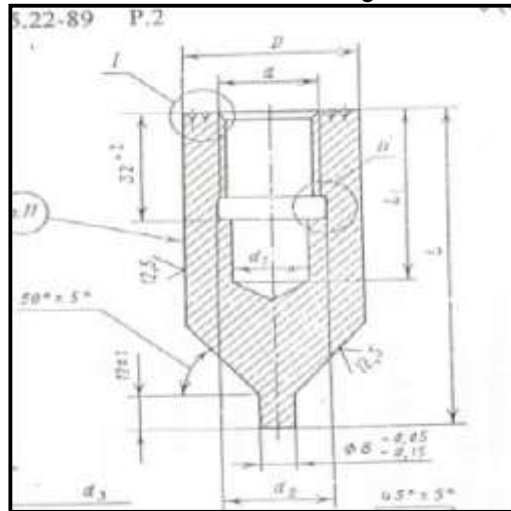
2.1 General Description:

- i. Branch pipe connections for vent, drain and I&C of process piping / tubing from the main pipe will be made using weld O-lets. These O-lets will be supplied in loose condition and are to be mounted on the supplied pipe spool / fabricated pipe spool. Material of construction of these O-lets shall be of carbon steel or stainless steel.
- ii. In addition to O-lets, for mounting various sensors such as for temperature measurement thermo well lugs will be mounted on the pipe lines. Thermo well lugs (boss) will be supplied in loose condition and shall be mounted at shop or at site insitu as indicated in drawings. Material of construction of these lugs shall be of carbon steel or stainless steel.

Typical construction of O-lets with dimensions.



Typical construction of Thermo well lugs with dimensions.



2.2 Mounting of O-let / Thermo Well Lug:

- i. As shown in the above sketches, O-let / Thermo well lugs are machined components made of forged material. These are machined for final external dimensions.
- ii. Erection, welding, drilling and inspection of O-lets / thermo well lugs shall be taken up on the pipe blocks in the contractor fabrication facility itself, before shifting of pipe blocks to site. However care shall be taken to prevent damage to welded O-let connection.
- iii. The contractor scope also includes o-let / thermo well lugs erection, welding, drilling on already erected pipe blocks at insitu. Equipments of required size & length to accommodate at places required for mounting the O-lets / lugs shall be mobilized by the contractor.
- iv. The diameters of the pipe blocks on which O-lets / lugs are to be mounted will range from 80 NB to 600NB. Mobilized machinery shall be able to accommodate this range of pipelines.
- v. ID of both O-let / Thermo well lugs will be in solid condition, ID shall be drilled through to the final dimension after welding of O let to the pipe block.
- vi. O-let / Thermo well lugs are need to be mounted on both small bore and big bore pipelines.

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- vii. Marking shall be carried out for position and orientation of the O-let. The same shall be offered for checking the correctness before proceeding for drilling pilot hole and pilot hole shall be drilled as per the marking to required diameter as per the configuration of the O-let.
- viii. Machinery required for drilling of pilot hole shall be arranged by the contractor. Drilling may be done using a pedestal drilling machine or radial drilling machine or pipe mounted drilling machine based on the size and configuration of the pipe block. Typical sketch of pipe mounted drilling machine is as shown below.



- ix. During mounting of drilling machines (in case of pipe mounted drilling machine) packing material shall be used to prevent direct contact of carbon steel with the stainless steel pipes.
- x. O-let / Thermo well lugs shall be mounted in the pilot hole. Fit up shall be made as per the requirements provided in the drawings and the relevant standards.

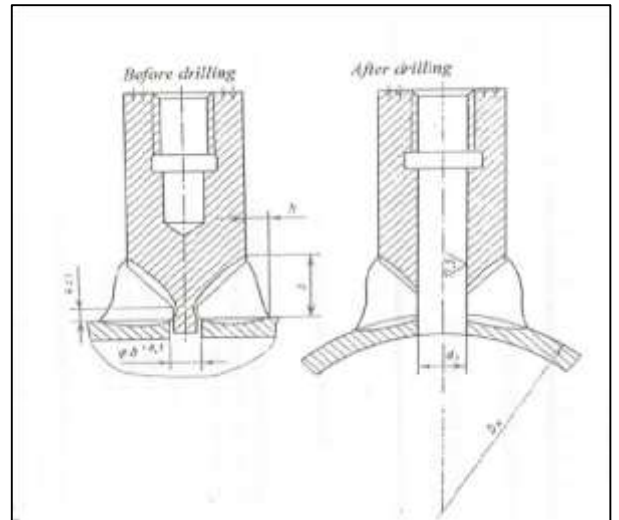
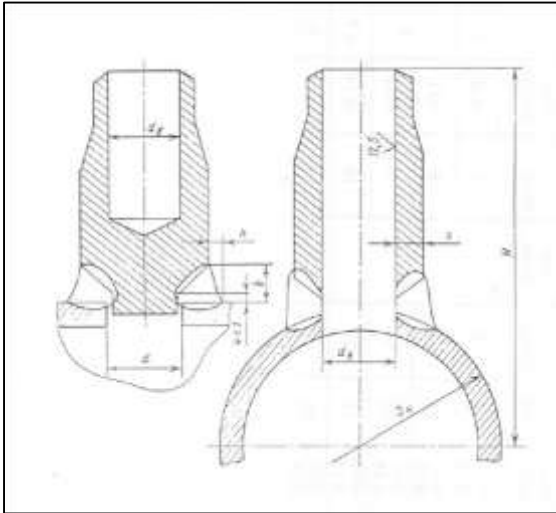
2.3 Welding and final drilling.

- i. Once fit up is completed, O-let / Thermo well lugs shall be released for welding as per the welding procedure.

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- ii. Welding of O-let / Thermo well lugs with the pipe spools shall be carried out using GTAW /SMAW.
- iii. On completion of welding of O-let / thermo well lug with the pipe spool, carryout inspection and other NDEs and clearance for final drilling shall be obtained.
- iv. Final hole dimensions shall match with the size of the connecting pipe. As mentioned above final drilling can be carried out using pedestal drilling machine/ radial drilling machine or pipe mount drilling machine based on the configuration of the pipe blocks.
- v. Arrangements of all the required drill bits of various sizes are included in the scope of work.
- vi. Care shall be taken while setting of machine for final drill in O-let / Thermo well lugs. Error in machine setting will lead to eccentric hole and non uniform thickness, damage to internal threads of the thermo well lugs.
- vii. While carrying out drilling on pipe block which is already erected in position, chips shall be removed out, in order to minimize the foreign material entry into the pipe line.
- viii. Post drilling cleaning shall be carried out to remove chips, oil , grease and any kind of foreign material, a thorough inspection shall be carried out after cleaning of the pipe block
- ix. Inspection shall be carried out using video boroscope for the O-let / Thermo well lugs from inside the pipe spool wherever it is inaccessible.
- x. In case drilling is to be carried out on the already erected pipe spool, care shall be taken for collection & or removal of drilling chips.
- xi. Schematic diagram of the O-let / Thermo well lugs in fit up after welding and final drilling is as shown below.

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3. Report & Records:

- i. Report shall be prepared as per the prescribed format and the unit of measurement shall be as per the schedule of quantities and rates.

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2.2.12 ERECTION, ALIGNMENT, FIT UP AND WELDING OF ORIFICE IN REACTOR AND REACTOR AUXILIARY BUILDING

CONTENTS

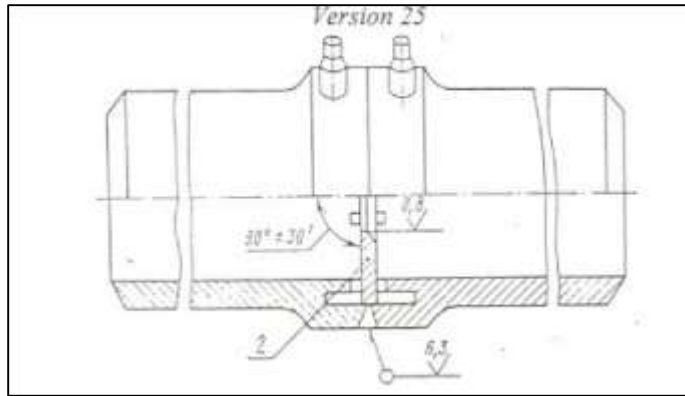
Sr No	Description
1	Introduction
2	Scope
3	Information and Sequence of activities
3.1	General Description
3.2	Flow measuring orifice
3.3	Throttling orifice
3.4	Flow throttling orifice
3.5	Handling & Erection
4	Reports and Records

1. Purpose: Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during handling, erection & fit up of the flow measuring orifice, throttling orifice & flow restricting orifice etc. to be erected in various systems under this contract.
2. Scope:
 - i. Study of drawings, preparation of network schedules.
 - ii. Preparation and approval of QAP, erection, welding and inspection procedures.
 - iii. Receipt of material from BHEL/NPCIL store, transportation, storage
 - iv. Receipt of material, handling & preparation of IMIR
 - v. De-preservation of orifices and checking the thoroughness of the orifice.
 - vi. Shifting, cleaning, erection and welding of orifice after flushing of completed system piping as per the location indicated in the working drawings.

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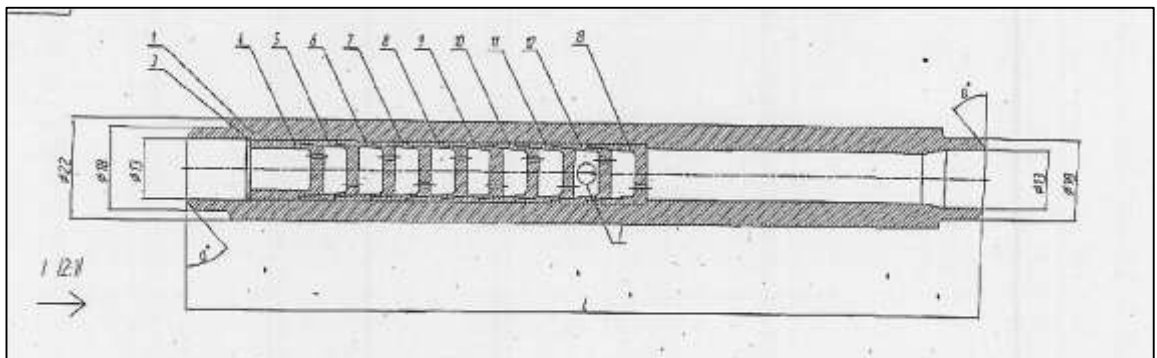
- vii. Inspection and carrying out other NDEs.
- viii. Preparation of reports and submission for acceptance.
- 3. Information and Sequence of activities:
 - 3.1 General Description:
 - i. Piping systems inside Reactor building and Reactor auxiliary buildings consists of various type of orifices of different configurations in the measuring / throttling /limiting the flow.
 - ii. These flow measuring orifices sizes ranges from 15NB to 500NB, and material of construction shall be of carbon steel and stainless steel.
 - iii. Orifices will be supplied in machined and pre-assembled condition.
 - iv. Orifices shall be erected on the piping systems in various floor & building at various elevations.
 - v. Detailed functions, scope of work in erection of these orifices are explained in the later sections.
 - 3.2 Flow measuring orifice.
 - i. Flow measuring orifice is used for measuring the flow in the main pipelines. As shown in the construction there will be a narrow opening for fluid to flow through the measuring tube. In this instrument two or more tubing connections will be taken from the orifice and connected to the respective instrument.
 - ii. For connection of tube, orientation of the nozzle of the flow orifice is very important and shall be ensured before releasing the orifice for welding.
 - iii. Since this device operates on the principle of venturi, direction of the orifice is very important, correctness of the direction of orifice shall be ensured before proceeding for welding.
 - iv. Construction details of the orifice given below

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3.3 Throttling orifice:

- i. Throttling orifices are the devices used to restrict the flow and pressure from the system.
- ii. These are erected in transition between the high pressure and low pressure lines for great pressure drops.
- iii. Typical construction of the throttling orifices shown in the below sketch.
- iv. In throttling devices depending upon the pressure drop there will be number of stages. Number of stages will increase with the increase in the pressure drop.
- v. Each stage of throttling orifice consists of small pin hole, whose diameter will depend upon the required pressure drop.
- vi. These holes in each stage will have greater possibility of chocking with any kind of foreign material due to its size.
- vii. At most care shall be taken to prevent the chocking of the orifice.
- viii. Also direction of the orifice to be erected shall be as per the marking punched on the orifice. This direction shall be matched with the flow direction.

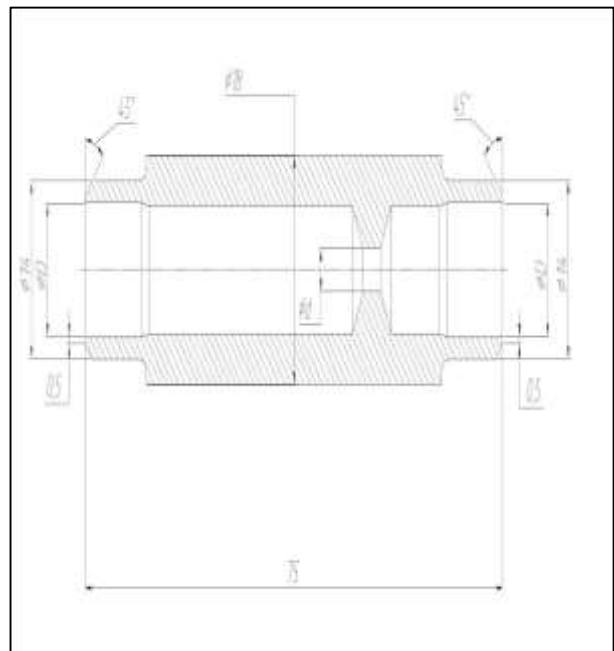
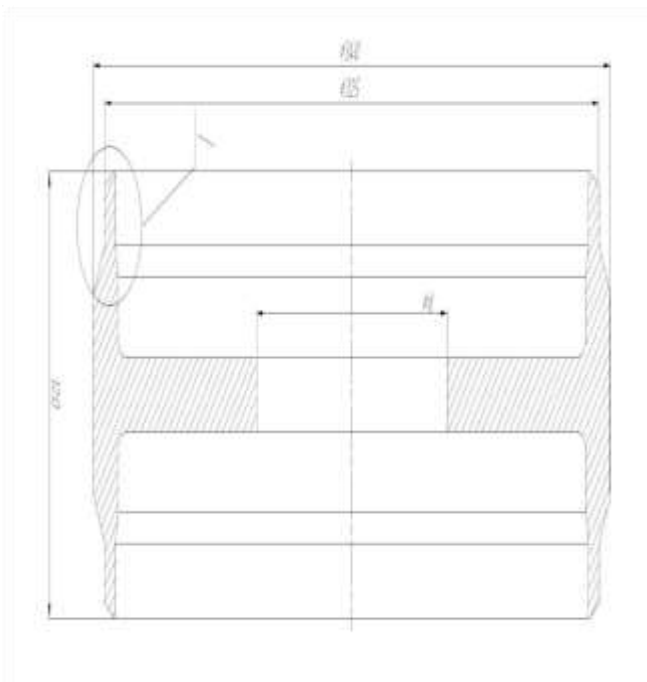


Throttling orifice

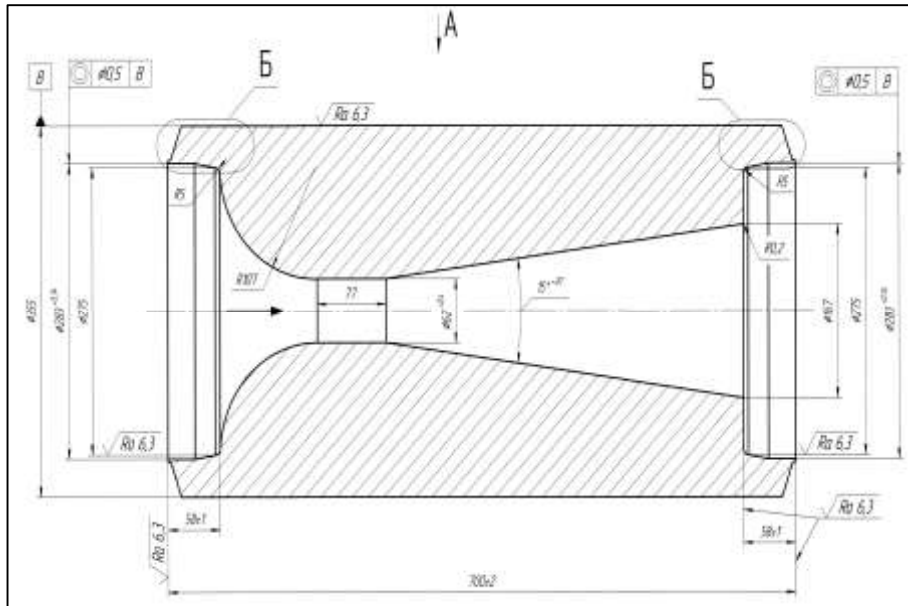
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3.4 Flow throttling orifice.

- i. As name indicates this is the orifice which is used to control the flow in the system.
- ii. This device is used to supply flow at constant value, and this is a machined component or a welded component.
- iii. Typical construction of the flow throttling orifice shown in the below sketch.
- iv. Flow throttling orifice may be provided with an arrow mark to match with the flow direction.



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water etc. based on the type of orifice. If any problem encountered in thoroughness of the orifice the same shall be brought to the notice of BHEL before proceeding for further action.

- viii. If thoroughness of the orifice is found satisfactory, orifice shall be fit-up with the pipeline, strictly as per the direction of flow marked on the orifice. Care shall be taken to ensure the arrow is matching the process flow direction. Non availability of flow direction in orifice if any shall be cleared before fit up.
- ix. In case of flow measuring orifice, the orientation of the nozzle is also important, and shall be ensured as per drawings/relevant document.
- x. Welding will be measured and paid in the relevant BOQ item.
- xi. The contractor also shall be responsible for cutting & removal and re-erection & welding of orifice in pipeline as instructed by the engineer.

4. Reports:

- i. Reports shall be prepared and submitted for accepted as per the format prescribed.
- ii. As built drawing with detailed dimensions and the orientation shall be marked and submitted to BHEL/NPCIL for acceptance.

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2.2.13 HANDLING, MARKING, CUTTING, FABRICATION, ERECTION, WELDING AND INSPECTION OF PIPE SUPPORTS.

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	Scope of work in detail
3.1	General Information and Requirements
3.2	Simple Sliding Support
3.3	Sliding Guide supports / Guide supports
3.4	Fixed supports
3.5	Hanger supports
3.6	Spring Hanger Supports:
3.6.1	Spring assemblies
3.7	Shock absorber Supports (Other than for NSSS)
3.8	Viscous elastic Damper
4	Reports and Records

1. Purpose:

This section will give detailed technical specification, general information and broad sequence of activities involved in handling, fabrication, erection of pipe supports of various types and sizes in the process systems covered this contract in various locations, elevations and buildings.

2. Brief Scope of work:

- i. Receipt of pipe support material from BHEL/NPCIL stores along with system pipeline, handling, transportation, uncrating, preparation of IMIR.

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- ii. De-preservation, segregating the pipe support members support wise (body of supports, spring assemblies, saddles, guides, hanger rods etc) and identifying all the members support wise.
- iii. Study of pipe support drawing, prefabrication of structural members which involves marking, cutting, grinding, grit blasting & inorganic zinc silicate primer application to required 75 microns DFT.
- iv. Shifting the pre-fabricated support members to the required location, erection, fit up, welding, and inspection of pipe supports and visco-elastic dampers.
- v. Carrying out other applicable NDEs, preparation of reports and submission for acceptance.

3. Scope of work in Detail.

3.1 General Information and Requirements:

- i. Piping material is made of carbon and stainless steel in these buildings, spread at various floors/rooms.
- ii. Efforts shall be made to erect the permanent support before erection of piping. Piping erection on temporary supports shall be permitted by Engineer only for those locations where permanent supports cannot be erected in advance. There will not be any extra payment for temporary supports provided for piping. Temporary supports shall be removed by the contractor at his cost immediately after erection of permanent support.
- iii. Erection of pipe supports shall be carried out as per the working documents for pipeline of 100 NB and above and small bore pipe 80 NB & below, the support location shall be decided jointly based on field routing of piping and support type shall be selected from standard support album unless otherwise specified in the drawing.
- iv. Various types of pipe supports to be erected are given below.
 - a. Sliding supports

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- b. Sliding guide supports
 - c. guide supports
 - d. Simple Hanger
 - e. Spring Hanger
 - f. Simple shock absorber support.
 - g. Visco elastic damper
- v. Detailed requirement of the pipe supports are explained in the later sections of this specification.
- vi. Supporting structure of the support is mounted on the wall either by welding on embedded part or welding on anchor plate fixed by anchor bolt.
- vii. Location of the supports is provided in the piping isometric Drawings. Any deviation from the designed location as given in the drawings is not permitted until unless an approval is obtained from BHEL & NPCIL.
- viii. Support material supplied will be in loose condition such as body of support, support clamp, clamp fasteners, shim plates, guide plates, hanger rod, spring assembly, supporting structure etc. These individual items are to be assembled at shop before shifting to site. The rate quoted by the contractor shall include involvement manpower & time accordingly.
- ix. Structural steel member such as channels, angles, plate, and beams of various sizes and thickness for the pipe support will be issued as free issue. In case of shortage / missing of support members, contractor shall supply as per approved Indian equivalent material. Payment of such item will be made in relevant BOQ item.
- x. Erection of scaffolding at required locations and elevations of various buildings covered under this tender.
- xi. Site survey shall be made for the location of the support based on the isometric drawings of pipelines and marking shall be made.
- xii. Detailed support fabrication drawings shall be provided by BHEL/NPCIL for big bore pipe support i.e. Dia greater than 100NB and above. Whereas for small bore

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pipings (80 NB & below) support fabrication drawings shall be made by the contractor based on the field dimensions and the standard album for small bore pipe supports. Following points shall be considered during developing the drawings for supports,

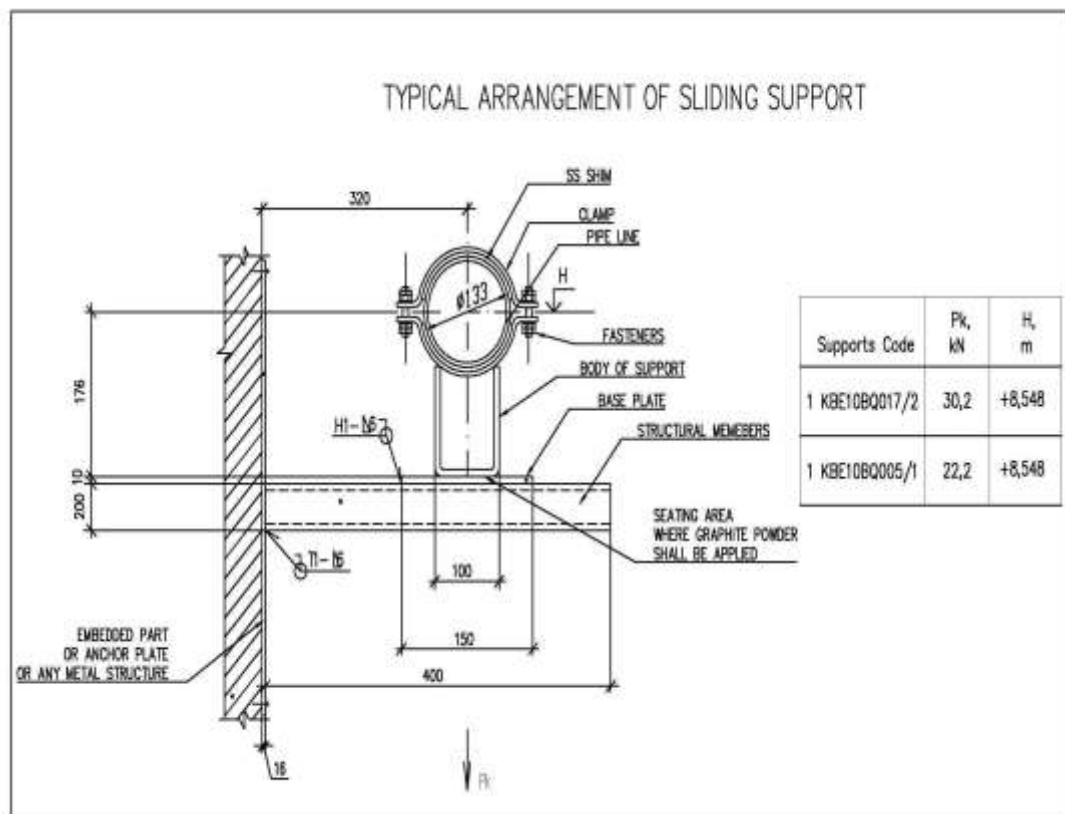
- a. Nearest embedded part shall be considered on priority.
 - b. Nearest metal structure or structure of any big bore pipe support shall be considered.
 - c. If no metal structure or EP is available, then use of anchor fasteners shall be considered.
- xiii. To the extent possible plan shall be made to pre-fabricate the support structure in fabrication shop and only final fit up and welding shall be planned at location.
 - xiv. Grit blasting of fabricated support structure & support members to required roughness as per SA 2-1/2, and application of zinc based primer over the grit blasted surface to required 70 microns DFT. Support primer painting is part of support item. For detailed specification of the grit blasting and primer application refer the technical specification for painting.
 - xv. Stainless shim plates shall be provided between the body of supports and stainless steel pipelines. Shim plate will be supplied along with the body of supports.
 - xvi. The contact surfaces shall be applied with graphite powder for sliding supports & guide supports. Supply and application of graphite powder is also under the scope of contractor within the quoted rate.
 - xvii. Welding of the support members as per the applicable and approved procedures.
 - xviii. After completion of erection of support, as built shall be prepared and submitted with all the dimensions, elevation, physical dimensions irrespective of size of the support or pipelines. Also as built shall include the supporting anchor / embedded part details etc.
 - xix. If the support is erected using any anchor bolts, fixing of anchor is also included in the scope of the contractor. Fixing of anchor is measured in separate BOQ item.

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- xx. Completed supports shall be applied with touch up primer where ever welding is performed. Scope includes Supply of primer and its application.

3.2 Simple Sliding Support:

- Typical construction of the simple sliding support is as shown below.
- This is a dead weight support, simply resting on the support structure.
- Care shall be taken during erection of sliding supports; there shall not be any gap between the resting plate and the body of support base.
- Once erection is complete, graphite powder shall be applied between the contact surfaces. Supply of graphite powder is in the scope of contractor.
- Body of support is supplied meeting specific requirements as per working drawings and are designated with typical Russian standards, Contractor shall take utmost care during erection of the body of support so that to prevent wrong selection and erection of body of support.
- Care shall be taken during welding of saddle to the pipeline not to damage the pipe line. Repair, required if any on this count, shall be at the risk and cost of contractor.

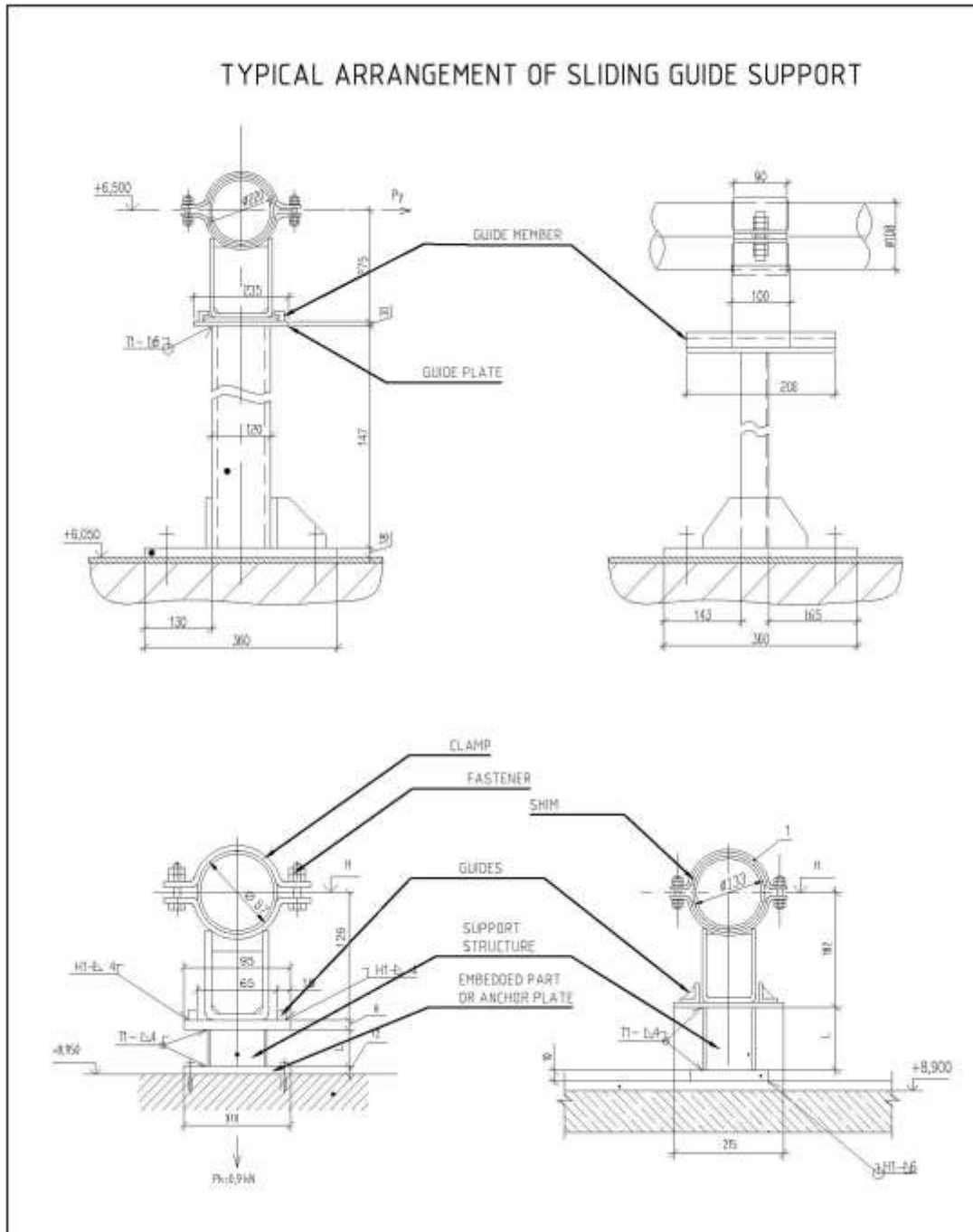


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3.3 Sliding Guide supports / Guide supports:

- i. The main parts of the guide supports are body of supports whose details are explained above and, supporting structure. In addition, these supports have an additional member called a guide plate.
- ii. These guide plates will be resting on the supporting structure by welding and body of support is rested on the guide plate, within the guide.
- iii. Note that in some occasions the guides will be supplied in loose condition, which shall be welded to the plate. These factors shall be considered during quoting the rate.
- iv. In general, horizontal pipe lines will be provided with the single guide plate, whereas vertical pipe line will be provided with the double guide plate.
- v. Typical construction of the guide and the sliding guide supports are as given below.
- vi. As explained earlier these are guiding members and hence there shall be free movement between the body of support and the guide plates. No gap shall be available between the resting surfaces and graphite powder shall be applied in mating areas.
- vii. Clearances shall be maintained as per drawing, between the guides and the body of support.
- viii. Various types of guide plates will be supplied in one system, correct type of guide plate shall be installed in the specified location.

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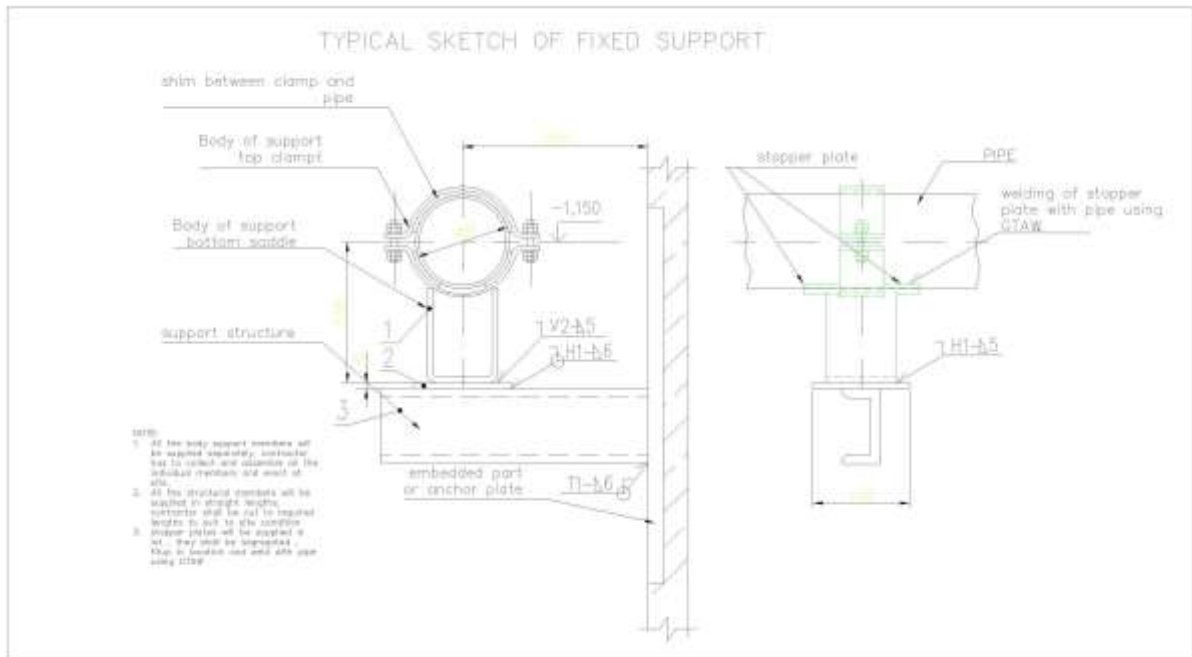


3.4 Fixed supports:

- i. As name indicates, fixed supports are not intended to move from the desired location.
- ii. Support erection shall be done as explained above, except that the body of support movement will be restricted in all directions by welding to pipelines and the structure.

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- iii. In this case the body of support mounted on the pipe will be directly welded on the resting plate. In addition to this one / two stopper plates will be welded on the pipe surface adjacent to the support bottom clamp on either side of the support to restrict relative movement of the pipe making the support fixed.
- iv. Material of stopper plates is similar to the pipe parent material. These stopper plates shall be welded to the pipe surface using GTAW process. Any repair/ additional weld joint required shall be carried out by the contractor at his own cost. These factors shall be considered while submitting the quote.
- v. In case of small bore supports, body of supports will be directly welded to the pipe, without any clamps. This welding has to be carried out using GTAW process taking care not to damage the pipe. Any repair/additional joint due to this repair will be at the cost of contractor.
- vi. Typical construction of the fixed support is as given below.
- vii. In addition to the above-mentioned scope of work, any other details and the requirements given in the working drawing shall is also included in the scope of work for successful completion of the work.



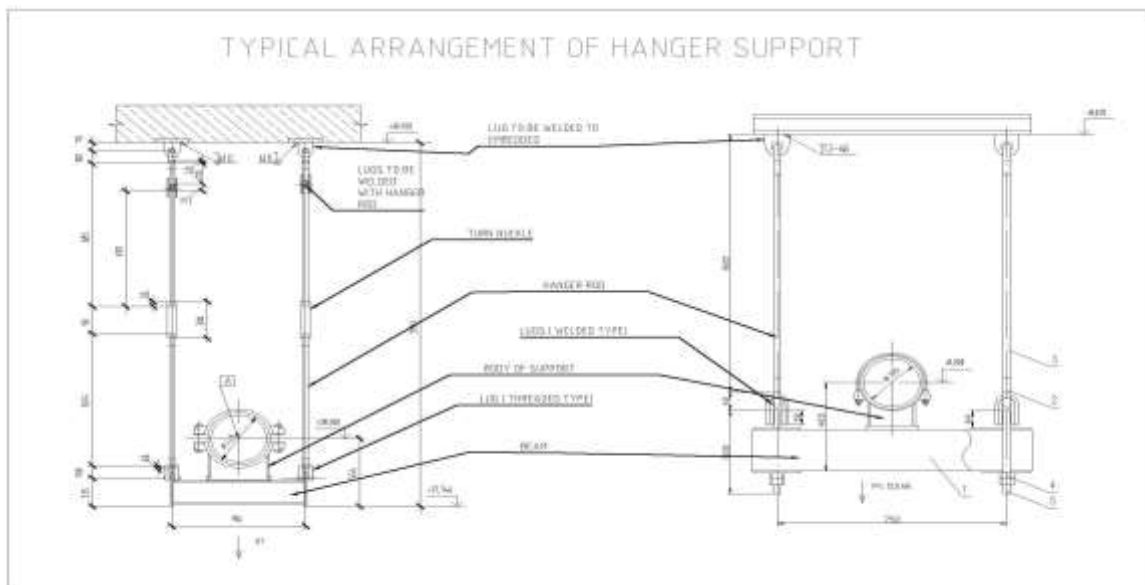
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3.5 Hanger supports:

- i. Hanger supports may be provided on the vertical run or horizontal run of pipes.
- ii. Hanger supports can be single rod hanger type or double rod type.
- iii. As bought out in earlier points, all the parts of the hanger will be supplied in loose conditions, i.e. lugs , rods (will be supplied in straight lengths), turn buckles, support clamps , fastening clamps, fasteners etc.
- iv. All the components shall be segregated support wise, identification marking shall be made by tagging or punching. Once identified and marked care shall be taken not to interchange the items.
- v. Rods shall be cut and ground as per the field measurement; all the clamps and the eyes shall be segregated, eyes shall be welded to the rods and shall be assembled at site with the clamp and the supporting member. The supporting member may be embedded part or a metal structure.
- vi. Joint between the rods and the eyes involves good quantum of welding. Welding will not be measured separately. Quoted rate shall include all these efforts/factors..
- vii. Rod sizes may vary from 8 mm to 40mm dia, the same in case of the eyes also.
- viii. In case of erection of hanger supports in location, utmost care shall be taken to ensure tightness of hangers. The complete weight of the pipe shall be transferred to the hanger. If any support is found in loose condition, it shall be rectified by the contractor without any additional cost implication.
- ix. The hanger support erection shall be planned and sequenced to ensure loading of all hangers. One type of hanger supports are provided with the turn buckles. Care shall be taken to ensure use of correct turnbuckle for the particular support. All threaded areas shall be protected before taking up fabrication, grit blasting etc, to avoid any damage.
- x. Hanger supports are also provided with the dowel pins with the locking rings for assembling the pipe saddle with the hanger members. These components shall be handled carefully. All such items shall be preserved with approved preservatives (grease/oil etc) to avoid rusting.

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- xi. Unhindered operation of hanger support shall be ensured during erection .Typical sketches of the hanger supports are as given below.
- xii. In addition to the above mentioned scope of work, any other details and the requirements given in the working drawing shall also included in the scope of work for successful completion of the work.



3.6 Spring Hanger Supports:

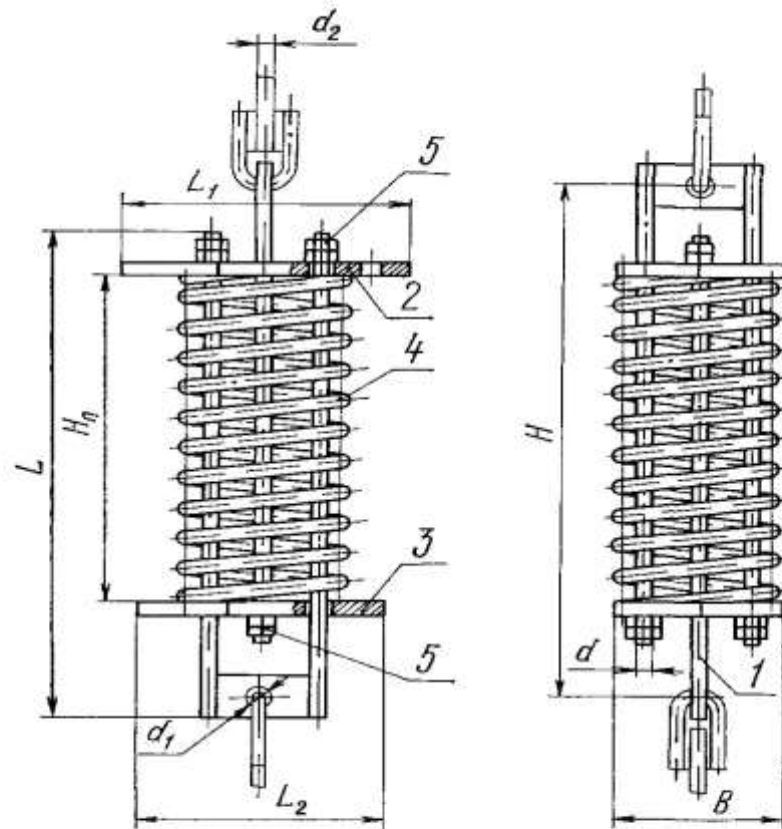
- i Spring hanger supports may be mounted on vertical and horizontal pipe runs.
- ii Similar to the simple hanger supports the main components of the spring hanger supports are Body of supports / clamps, supporting beam, hanger rods, eyes/lugs, shims etc. apart from spring assembly.
- iii As brought out earlier all these components will be supplied in loose condition i.e. clamps, shims, rods, lugs, spring, spring plates, spring assembly rods, fasteners etc. All these components shall be identified & segregated support wise before proceeding for fabrication.
- iv Similar to hanger supports as per the field measurements, rods are to be cut and ground to the required length and assembling the lugs / eyes with the rods and welding shall be performed.
- v Similar to the other supports, these spring hanging supports also may be supported from the embedded part or anchor plate mounted using anchor bolts or nearest metal structure.

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3.6.1 Spring assemblies:

- i. Spring assemblies are identified by separate and unique Russian standard. They are classified based on the stiffness, compression and free height of the spring. Hence springs are not interchangeable.
- ii. First activity shall be segregation of all the parts of the spring assembly support wise, assemble the spring with the spring plates and the rods using fasteners.

TYPICAL SPRING ASSEMBLIES

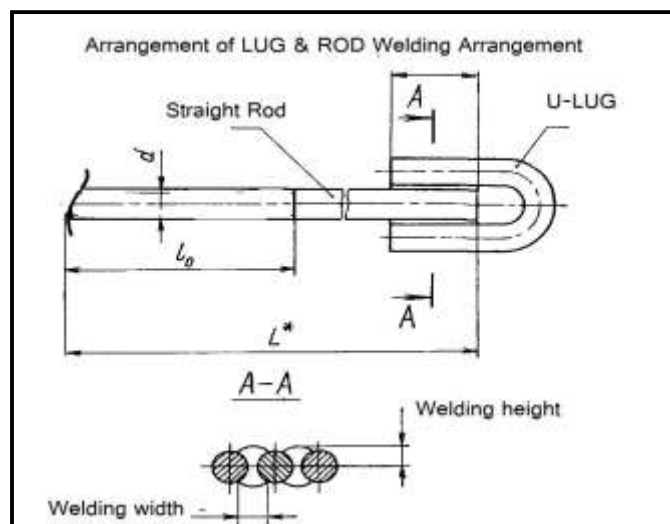


- 1) Clamping Rod 2) Spring locking plate 3) Spring locking plate 4) Spring
5) Lock Nut

- iii. All these spring hanger supports are provided with a requirement of spring heights to be maintained during the erection condition and during operation condition.
- iv. Spring is supplied in free state. Before proceeding for assembly of components, spring dimensions such as free height & wire diameter shall be checked and ensure whether the spring being erected is as per the requirement or not.

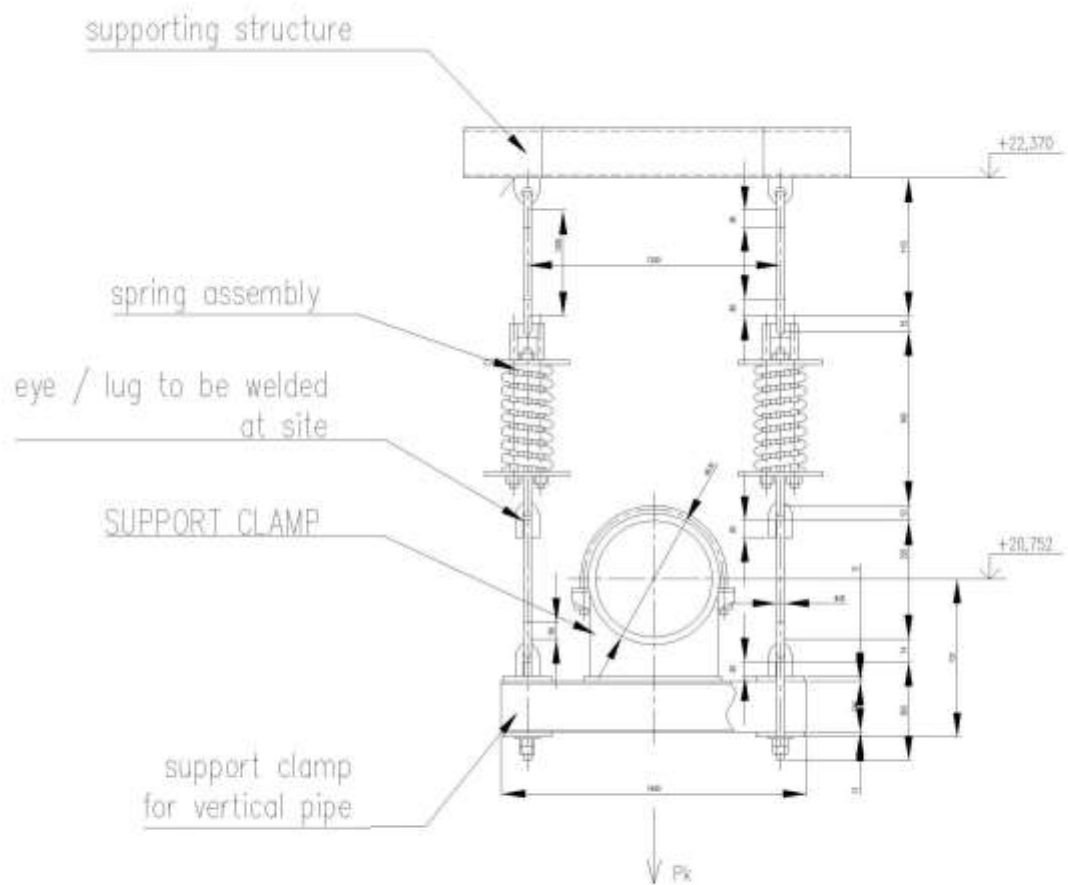
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- v. Since the quantity of the spring hanger supports are very huge for carrying out pre-compression and locking the spring there shall be a jig / fixture fabricated, so that before taking the spring assembly to the location spring shall be set and locked to the required dimension.
- vi. Spring shall be assembled and dimensions shall be set as per approved drawings before erection. i.e. dimension H or H_n in the above sketch Once the spring assembly is set and locked, it can be erected in position and welded.
- vii. Lock of the spring shall be released after getting clearance from Engineer. Spring height shall be re adjusted, if found to vary after releasing of locking. Spring assemblies may be provided below the pipe saddle or above the pipe saddle as shown in the sketch.
- viii. Spring assemblies provided on the vertical pipe will be provided with a stopper plates for taking the load of the pipe, these plates are to be welded to the pipe using GTAW process. Stopper plates will be supplied on free issue basis.
- ix. The manpower involvement & other requirements of the job shall be kept in mind while quoting the rates.
- x. Arrangement of typical spring support assembly on horizontal and vertical pipelines is as given below.



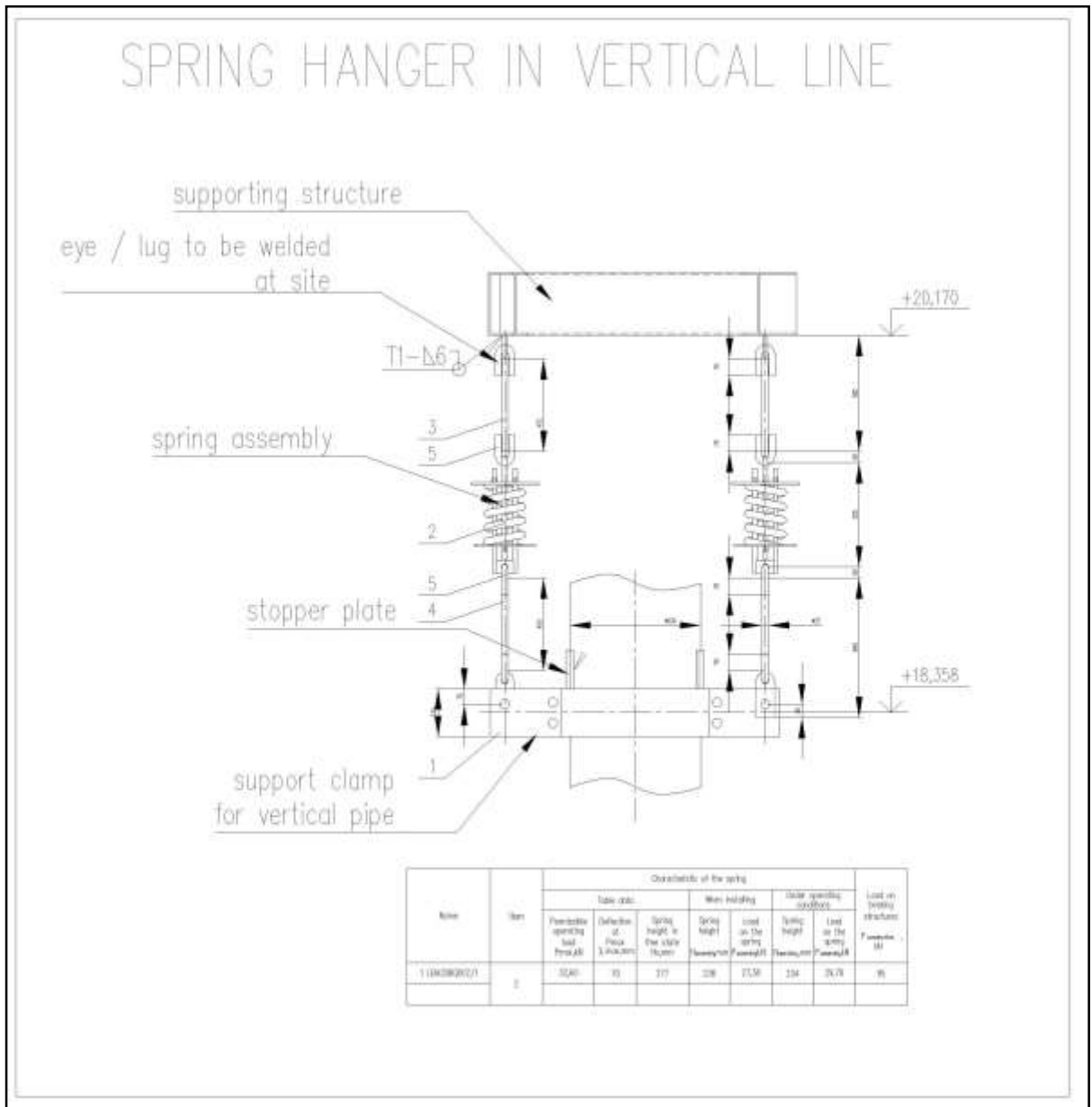
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SPRING HANGER IN HORIZONTAL LINE



Name	Size	Characteristics of the spring							
		Static state			When installing		Under operating conditions		Load on hanger structure
		Permissible operating load (N/mm²)	Deflection of free hanger (mm)	Spring height in free state (mm)	Spring height (mm)	Load on the spring (N/mm²)	Spring height (mm)	Load on the spring (N/mm²)	
1 18A20B003/1	3	40.80	70	284	244	35.20	248	35.35	128

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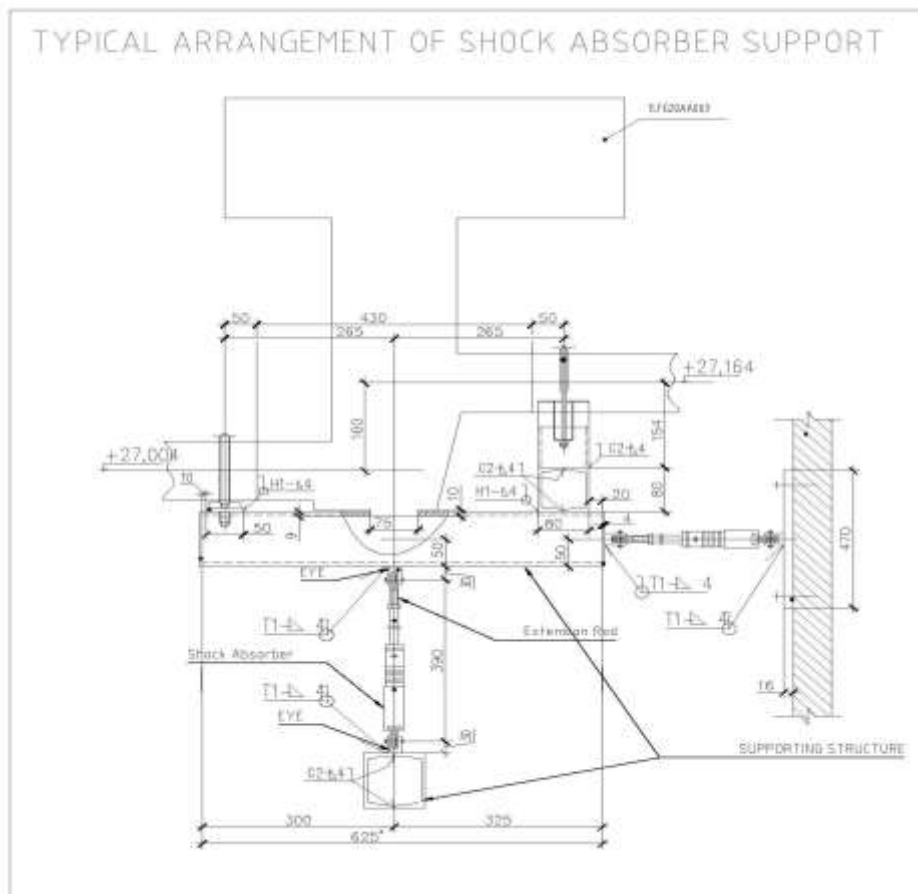
3.7 Shock absorber Supports: (Other than for NSSS):

- i. Some of the piping systems are provided with the shock absorber type pipe supports.
- ii. Typical arrangement of such support is as shown in the sketch below.
- iii. Mainly this kind of support consists of Body of support, structural members and a member called shock absorber.
- iv. All these members are supplied separately and shall be segregated support wise before taking up erection.
- v. Orientation of the support shall be marked properly at site while laying out to meet the angular orientation requirement as per drawings. The dimensions eye to eye

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shall be maintained as per the drawing. Before taking up erection of these supports proper planning is required in marking and cutting of the structural members, dimensions between the eyes shall be maintained perfect, so that the provided shock absorber will seat in the position without any alteration or modification.

- vi. Support structure shall be mounted taking support from metal platform or concrete wall as shown in drawing..
- vii. One support may contain more than one number of shock absorbers.
- viii. Dimensional requirements of all the shock absorbers shall be fulfilled.
- ix. Any deviation in the dimensions shall need approval from Engineer.
- x. Typical arrangement of the shock absorber support is as shown in the figure below.
- xi. In addition to the above-mentioned scope of work, any other details and the requirements given in the working drawing shall also include in the scope of work for successful completion of the work.



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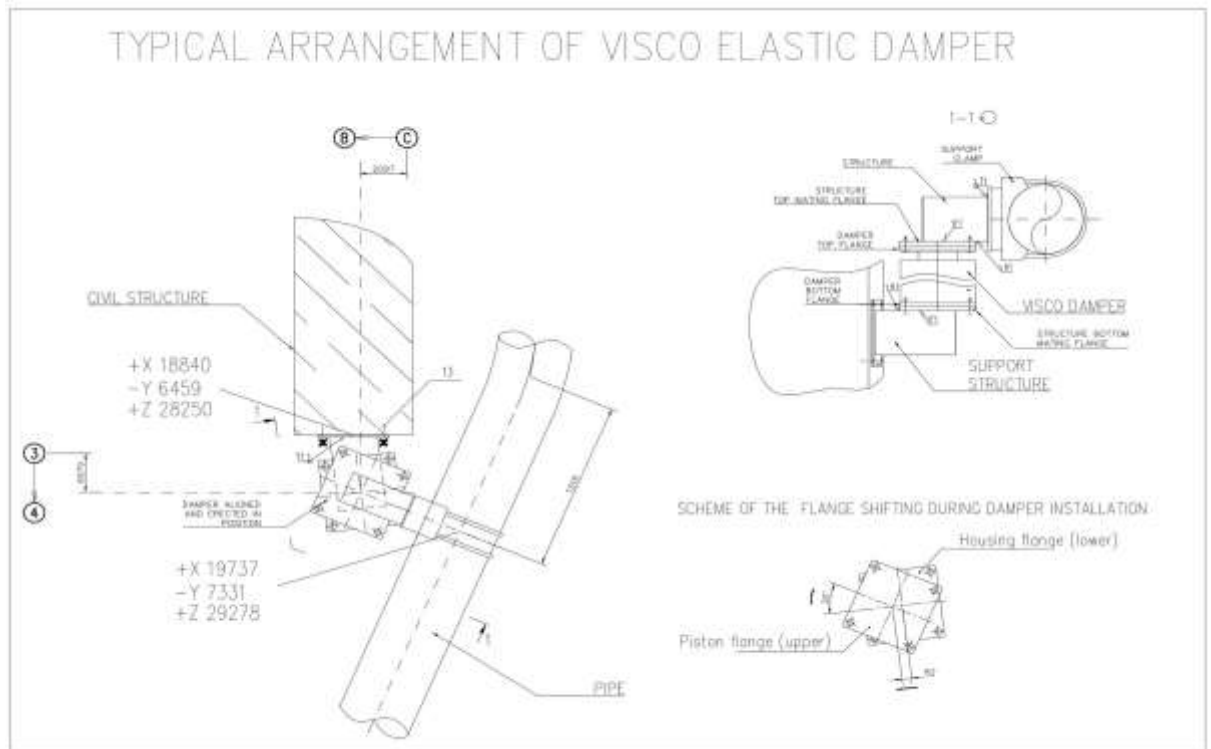
3.8 Viscous elastic Damper:

- i. Typical arrangement of the viscous elastic damper support is as shown in the sketch.
- ii. The main purpose of this damper is to isolate the vibrations to and from the system to the civil structure and vice versa.
- iii. The main components of this support are, viscous elastic damper, supporting structure, top and bottom flange & fasteners.
- iv. These dampers may be provided separately on the pipe line or assembled along with the spring hanging support. If the damper is assembled with the spring hanging support, each item will be measured in the respective BOQ item, i.e. spring hanger will be measured in the support item and the damper will be measured in the damper BOQ item.
- v. There is wide range of dampers whose weight varies from 20kg to 1000kg approx.
- vi. Utmost care shall be taken during handling these dampers, as these dampers contain a viscous fluid. Any mishandling, damage and loss of viscous fluid during handling, transportation and erection shall be arranged by the contractor at his risk and cost.
- vii. The rubber covering provided on the damper is very delicate and care shall be taken during handling of the dampers to ensure this does not get damaged. Suitable protection shall be provided after erection.
- viii. Dampers are mounted in vertical condition irrespective of the direction/ orientation of pipes.
- ix. Structural members for this damper are pre-formed box type members, supplied in free lengths; these shall be cut to the suit to site condition and erected. In some cases members are fabricated out of plates of various thicknesses.
- x. Field measurements shall be taken with respect to the drawings
- xi. Proper planning is required for shifting, handling and erection of dampers.
- xii. The main requirements for erection of the dampers are location, height of the damper, and orientation of the flange. Any deviation in all the above readings is not permitted.

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- xiii. Damper will be supplied in locked condition for transportation purpose; this lock shall not be removed till the damper is shifted to the location, and is to be removed only just before installation.
- xiv. There are two mating flanges of the damper, one flange is to fasten with the flange on the member from civil structure and other to fasten with flange on the member coming from pipe.
- xv. Before erection of the damper, damper shall be unlocked with the transport locking arrangement, and damper flanges shall be preset to the readings provided in the drawings i.e. orientation and the height of the damper, once it is ensured damper shall be locked using in-situ locking arrangement.
- xvi. Supporting members shall be erected in position in line with the body of support mounted on the pipe.
- xvii. Orientation of the mating flanges shall be adjusted at par with the orientation of the damper, and fit up shall be made.
- xviii. Damper shall be placed in location and check whether the mating flanges are matching with the flanges of the damper, if not corrections shall be made before taking up welding of flanges & associated members. Damper shall be removed from location during the welding operation.
- xix. Re-erect the damper in the location; fasten the flanges as per the requirement.
- xx. Multiple handling of damper may be required during the erection & alignment process. Rate quoted shall be inclusive of all such multiple handling.
- xxi. In addition to the above mentioned scope of work, any other details and the requirements given in the working drawing shall is also included in the scope of work for successful completion of the work.

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4. Reports and Records:

- i. All the information of the fabricated and erected support shall be made in to as built with detailed bill of material and shall be submitted for acceptance of BHEL/NPCIL.

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2.2.14 SUPPLY, FABRICATION, GRIT BLASTING, PRIMER APPLICATION, ERECTION, WELDING AND PAINTING OF METAL STRUCTURE

CONTENTS

Sr No	Description
1	Purpose
2	Brief Scope of work
3	Detailed scope of work
3.1	Supply of Raw material
3.2	Fabrication
3.3	Grit blasting & painting
3.4.1	Erection
3.4.2	Field Connections
3.4.3	Metal grating erection
3.4.4	Hand rails and toe guards
3.5	Modification
4	Inspection
5	Reports and Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during fabrication and erection of metal structure in various buildings covered under this contract.

2. Brief Scope of Work:

The contractor scope work involves but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection, welding and inspection procedures.

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- iii. Supply of structural steel material conforming to IS 2062, E250, Quality B0/BR consisting plates/ sheets/ angle/ channel/ beam, metal gratings, high strength structural cadmium coated bolts, nuts, lock nuts and washers, with test reports, transportation, storage, and acceptance with IMIR.
 - iv. Handling, fabrication involving cutting, grinding, bending to required shape, drilling, fit up & welding, surface preparation by grit blasting, supply & application of zinc based primer.
 - v. Erection of scaffolding / temporary platforms for erection of the metal structures.
 - vi. Shifting, erection, welding & inspection of fabricated metal structures & gratings in the required location of various buildings as per the working drawings and technical specification.
 - vii. Machining of seismic arrester plates for mounting the beams, fastening of beams with the brackets to required torques as per the requirements.
 - viii. Supply and application of epoxy based Apcodur 641 or Apcodur 641CS of Asian paints or protectomastic of Berger paints or any other equivalent paint with prior approval from BHEL for a total DFT of 240-260 microns.
3. Detailed scope of work:
- 3.1 Supply of Raw material:
- i. Raw material shall conform to IS 2062, E250 GRADE and Quality B0/BR, until unless specified in the drawings.
 - ii. Indian equivalent material as against Russian grade materials is specified in Table-1.
 - iii. Profile standards shall be as per IS 808, until or unless not specified in the drawings.
 - iv. Supplied material shall be produced with original test certificates from approved manufacturers / tested at the NPCIL approved laboratories.
 - v. Supply of raw material shall be from NPCIL approved manufacturers only. List of approved brands of NPCIL may be referred.

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- vi. Supply also includes necessary self tapping screws for fixing metal grating with members. Also necessary mechanical fasteners of various strength class for assembly and erection metal structures.
- vii. Electrodes (E-7018 electrodes of NPCIL approved brand) and filler wires for welding shall be from NPCIL approved manufacturers/ suppliers. They shall be baked as per manufactures recommendations/specifications prior to welding. The electrodes shall be kept in carry ovens and shall not be exposed to the atmosphere.
- viii. Supply of zinc silicate primer as per the painting specification.
- ix. Supply of epoxy based Apcodur 641 or Apcodur 641CS of Asian paints or protectomastic of Berger paints or any other equivalent paint with prior approval from BHEL & NPCIL for a total DFT of 240-260 microns. With required test certificates.

3.2 Fabrication.

- i. Contractor has to develop detailed fabrication drawings based on the basic drawings issued by BHEL/NPCIL. Contractor has to design the weld sizes in-case that were not provided in the working drawing based on RF codes and standards.
- ii. Scope includes arrangement of necessary tools, tackles, machinery, consumables, welding electrodes, cleaning agents, bending machines, etc.
- iii. Scope also includes arrangement of necessary and qualified manpower for carrying out the job.
- iv. Carryout field survey, measurement as per field condition, taking the field measurements and comparing with the dimensions provided in the drawing. If there are any difference between the field condition and the drawing dimension, the same shall be brought to the notice of Engineer.
- v. After obtaining the clearance from Engineer, marking and cutting shall be done as per the field condition.
- vi. All fabrication and erection shall be taken up as latest revision of drawings and DCNs / instructions issued.

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- vii. No holes are permitted using gas cutting, only drilling machine shall be used for performing drilling operation.
- viii. Connection between the bracket and the members are locked by special arrangement with different profile for withstanding the seismic loads. Such profile cutting shall be done only using special machinery or milling machine etc. No gas cutting is permitted as the tolerances in the seating areas are very close.
- ix. Also in some locations beams are of fabricated type instead of readymade sizes, this involves huge quantum of welding. Bidder shall consider these factors while submitting the offer.

3.3 Grit blasting, primer application and painting.

Refer technical specification for grit blasting and painting.

3.4 Shifting and Erection of metal structure:

3.4.1 Erection

- i. Fabricated, grit blasted and painted structure shall be shifted to the erection site.
- ii. Meticulous planning is required while erection of the metal structure. Since there will be other agencies working in the same area for various works, contractor shall not dump the material at once in the site. Shifting of material at location shall be done in a phased manner based on the daily or weekly planning. And this shall not hamper the work and cause hindrance to the other agencies.
- iii. For erection, contractor shall consider that there will be other agencies working in the same area. In view of this proper planning and a cordial relation with the other agencies shall be maintained.
- iv. Carrying out survey for mounting the brackets, identifying the embedded parts for the brackets, in case the brackets are to be mounted using the anchor fasteners, the same shall be carried out by the contractor. Measurement and payment for the anchor fasteners will be done in the relevant BOQ item.
- v. Many areas where platforms to be erected is provided with the liner to prevent water ingress into the concrete. In view of this no dragging of fabricated structural

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steel shall be permitted. Even with liner or without liner. Any damage to the liner shall be rectified by contractor at his own risk and cost.

- vi. To the extent possible only erection and assembly works shall be carried out at site. Maximum fabrication shall be carried out in fabrication shop. Welding shall be as minimum as possible.
- vii. Without application of primer material shall not be shifted to site for erection.
- viii. As explained above there is special arrangement between the beam and the bracket, in-order to withstand the seismic loads. Typical arrangement is as shown in sketch-1.
- ix. Beam alignment with the bracket axis shall be done carefully, it shall be noted that the beam axis shall match with the bracket axis.
- x. Levels shall be ensured after placing the beams; any adjustments shall be made in the brackets. Horizontality shall be maintained as per the working drawings.

3.4.2 Field Connections:

- i. Field connections by bolting are by using High tensile bolt and nut as per the strength class of the WD or Russian standard or its equivalent of Indian standard turned bolts or welding.
- ii. All bolts, nuts, washers, taper washers, electrodes, screws etc. are to be the Contractor's supply.
- iii. Bolts shall be tightened by proper established sequence" Manual Torque Control" where tightening is by hand wrench equipped with a torque indicator and calibrated for the desired bolt tension of WD.
- iv. The Contractor shall obtain the prior written approval of the Engineer for the method proposed (procedure) to be adopted for tightening the High strength friction grip bolts. For preliminary assembly and before use of these bolts, he shall use his own erection bolts.
- v. Bolt spacing shall be decided based on RF codes and standards.

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3.4.3 Metal grating erection:

- i. Top of the metal platform are provided with metal grating with approx 20mm angle with combination of strips and the rods.
- ii. Scope includes fabrication and erection of the metal gratings also.
- iii. In view of work involved and the production rate, supply, fabrication and erection of metal gratings were kept under separate item of BOQ.
- iv. Metal platform shall be installed along with the metal gratings, platforms shall not be left without gratings, and this will lead to safety hazard. If any platforms erected without metal gratings, payments of such gratings will be kept under hold as per the stage payments.
- v. Metal gratings may be fabricated at site or readymade grating may be purchased from the market, this option is left with the contractor. Whereas prior approval shall be obtained from BHEL/NPCIL in any case. Also BHEL & NPCIL approval and quality shall be full filled even for brought out items.
- vi. Usually fastening of the metal gratings to the metal structure was carried out using the self tapping screws. Supply of such self tapping screws is included in the scope of work.

3.4.4 Hand rails, ladders and toe guards:

- i. Completed metal platforms shall be provided with the hand rails, where ever designed openings are provided.
- ii. Such hand rails are provided with the toe guards, until unless it is specified in the drawings.
- iii. Also scope includes erection of the ladders and landings for making the approach to the higher elevations.
- iv. All these works includes fabrication and erection of very light structures which involves lots of efforts where the production rate will be very less when compared to the metal platforms. Contractor shall consider all these factors while submitting the bid for fabrication and erection of the light metal structure.

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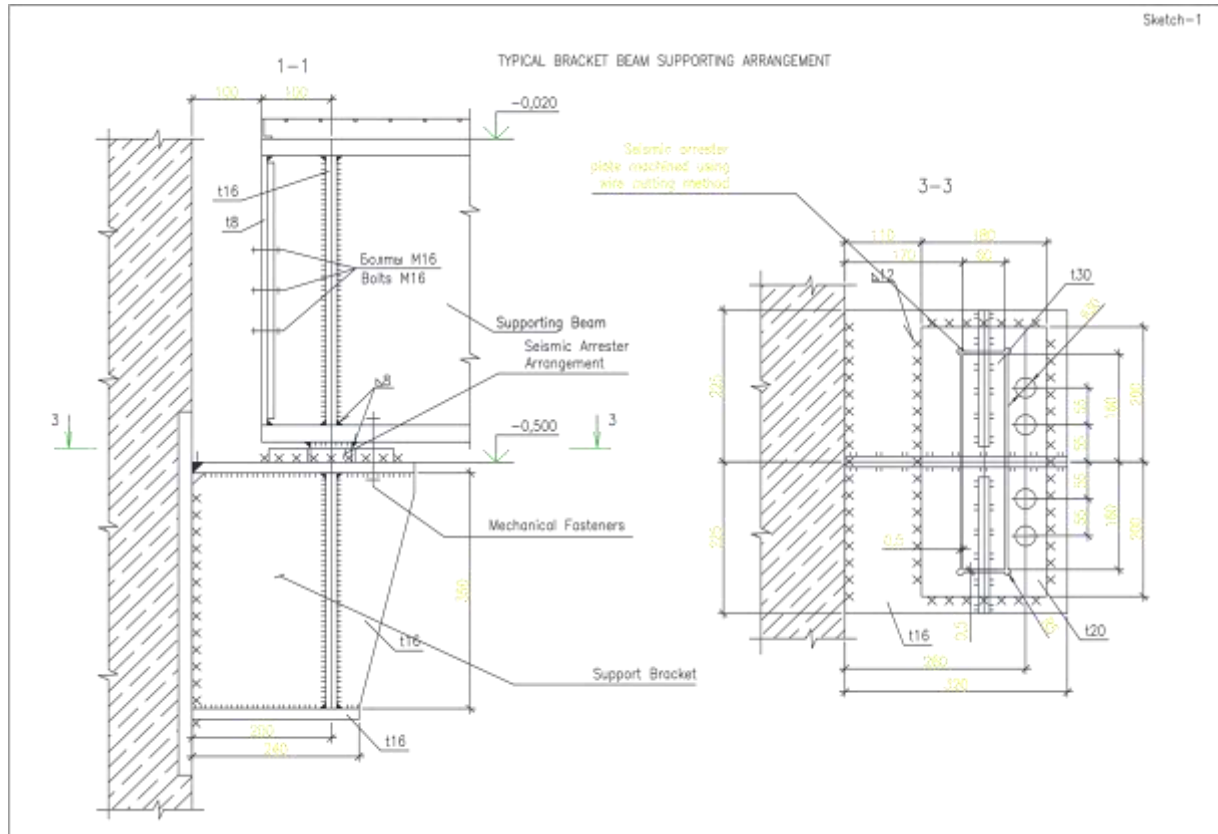
- v. Handrails shall be provided on sides of platforms, stairways and around all openings as shown on drawings. Unless specified Handrails shall be of hollow square tube 40X40 mm or mild steel pipe of flush welded construction, ground smooth, using 32 mm nominal bore medium class pipe provided with double rail, top rail about 1000 mm above platform level and pipe posts spaced not more than 1.5m apart and 150 mm high 6mm thick toe plate.

3.5 Modification of the existing platforms & gratings:

- i. Metal platforms once erected (Erected in this contract or by other agencies) are subjected to modification due to modification in piping supports, due to any design change, due to any other changes.
- ii. This modification includes cutting of existing platform members, gratings, modifying the dismantled ones or fabricating the new ones and carrying out erection as per the modified drawings.
- iii. During carrying out modification, for gas cutting or for carrying out grinding, fire resistant fabrics shall be used so that to prevent the spatter to fall on the equipment, pipes, valves, cables etc laying below.
- iv. Scope includes such modification also. Payment for such modification will be measured and made in the relevant BOQ item.

4. Inspection:

- i. Inspection includes various NDE such as visual inspection and DPT as specified in working drawings.
- ii. There is no separate payment for NDE, scope includes NDEs also for metal structure works.
- iii. Inspection shall be offered to BHEL execution and quality based on the approved QAP. There shall not be any deviation from the QAP. In case any deviation found there is every right to BHEL/NPCIL to order rework at risk and cost of contractor.



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Table -1
INDIAN EQUIVALENT MATERIAL FOR RUSSIAN GRADES

SRNO	Russian Grade specified in WD's	SECTION	Acceptable Indian Grade	Remarks
1	S235" as per GOST 27772-88	Rolled sections	Grade "E 250 Quality A" as per IS 2062-2011	
		Plates (all thicknesses)	Grade "E 250 Quality A" as per IS 2062-2011	
2	S245" as per GOST 27772-88	Rolled sections	Grade "E 250 Quality A" as per IS 2062-2011, with additional impact requirement of 27 J at room temperature (25°C)	Impact tests shall be conducted on products having thickness less than 12mm also in accordance with clause 12.1.1 of IS:20622011.
		Plates (all thicknesses)	Grade "E 250 Quality BR" as per IS 2062-2011	
3	S255" as per GOST 27772-88	Rolled sections	Grade "E 250 Quality B0" as per IS 2062-2011 with additional impact requirement of 27 J at (-)20°C	Impact tests shall be conducted on products having thickness less than 12mm also in accordance with clause 12.1.1 of IS:20622011.
		Plates (all thicknesses)	Grade "E 250 Quality C" as per IS 2062-2011	
4	"S345" as per GOST 27772-88	Plates (all thicknesses)	"SAILMA 350 HI" with additional impact requirements as per Special Note (a) below	
5	S375" as per GOST 27772-88	Plates (all thicknesses)	"SAILMA 410 HI" with additional impact requirements as per	

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			Special Note (a) below	
6	S235" as per GOST 27772-88 and sizes as per IS 1161	Pipe sections	Hot finished seamless tube (HFS) of YSt 240 as per IS 1161-2014	
7	"S245" as per GOST 27772-88 and sizes as per IS 1161	Pipe sections	Hot finished seamless tube (HFS) of YSt 240 as per IS 1161-2014 with additional impact requirement of 27 J at room temperature (25°C)	Impact tests shall be conducted on products having thickness less than 12mm also in accordance with clause 12.1.1 of IS:20622011.
8	"S255" as per GOST 27772-88 and sizes as per IS 1161	Pipe sections	Hot finished seamless tube (HFS) of YSt 240 as per IS 1161-2014 with additional impact requirement of of 27 J at (-)20°C	Impact tests shall be conducted on products having thickness less than 12mm also in accordance with clause 12.1.1 of IS:20622011.
9	"S235" as per GOST 27772-88 and sizes as per IS 1239	Pipe sections	Hot finished seamless tube (HFS) of UTS 320 MPa as per IS 1239 (Part 1)-2004	

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2.2.15 SUPPLY AND APPLICATION OF EPOXY PAINT INCLUDING GRIT BLASTING AND PRIMER APPLICATION.

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	General information and scope of work in detail.
3.1	General:
3.2	Grit Blasting & Primer application:
3.3	Epoxy Paint Application
3.4	Inspection, Qualification:
4	Reports and records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during supply and application of zinc silicate primer, supply & application of epoxy paint on pipeline supports & metal structures. The work also includes providing facilities for supply and carrying out grit blasting.

2. Scope:

The contractor scope work involves but not limited to the following.

- i. Study of drawings, Preparation and approval of QAP, erection, procedures.
- ii. Supply of zinc silicate primer of NPCIL approved brand.

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- iii. Supply of Apcodur 641 or Apcodur 641CS of Asian paints or protecto mastic of Berger paints or any other equivalent paint.
 - iv. Receipt of material, transportation, inspection and storage.
 - v. Establishing grit blasting facility, grit blasting and application of zinc silicate primer to as specified in drawings. Unless otherwise specified the thickness of primer coating (DFT) shall be 60 to 70microns.
 - vi. Application of epoxy paint as per the requirement over pipe supports & metal structure to required thickness.
 - vii. Preparation of reports and submission for acceptance.
3. General information and scope of work in detail.
- 3.1 General:
- i. All the metal structures, pipe supports and other miscellaneous structures inside Nuclear Island buildings are needed to be painted.
 - ii. Preparation of work procedure & quality plans and submission for review and approval from BHEL.
 - iii. Painting systems needed to be followed shall be of NPCIL approved. Any other equivalent may be proposed from the end of contractor.
 - iv. All the PIPE SUPPORT/STRCUTURES shall be grit blasted, primer applied before shifting to the site.
 - v. Final paint may be applied (Leaving the weld area) on the members before shifting to the site as instructed by the engineer.
 - vi. Erection of scaffoldings and temporary platforms for painting in location.
 - vii. Scope includes supply, storage of paint, including cleaning aids like kerosene, acetone, cotton waste etc and submission of test reports, preparation of IMIR for BHEL & NPCIL acceptance.
 - viii. Set up painting facilities at site complete with all necessary equipment such as compressor for grit blasting, primer application & paint application, air less paint equipment etc.

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- ix. Qualification of girt blasters and painter shall be carried out as per the approved procedures.

3.2 Grit Blasting & Primer application:

- i. Piping and the pipe support material supplied on free issue basis by BHEL/NPCIL will be supplied in the preservative applied condition. This paint shall be removed using grit blasting process.
- ii. Contractor supplied material shall be grit blasted and primer applied after fabrication and before proceeding for erection.
- iii. Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained.
- iv. The surfaces shall be blast cleaned using one of the abrasives like chilled cast iron or malleable iron and steel at compressed air pressure of 7kg/cm² at a appropriate distance and angle depending of nozzle size maintaining constant velocity and pressure.
- v. Unless otherwise specified, surface preparation shall be carried out for surface roughness of Sa 2-1/2.
- vi. Surface roughness measuring Tools like presso film with micrometer / roughness comparator shall be arranged by contractor.
- vii. Blasted surface shall be cleaned thoroughly using compressed air.
- viii. Painting of primer & epoxy shall not be permitted during rainy / wet condition. Primer shall be applied in the conditions specified by the paint manufacturer.
- ix. The first coat of primer must be applied by airless spray/ air assisted conventional spray on dry surface. This should be done immediately and in any case within 4 hours of cleaning of surface.
- x. Carryout primer wet and dry film thickness for acceptance.
- xi. Adequate number of instruments (Elcometer) for measuring WFT & DFT shall be arranged by the contractor.

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3.3 Epoxy Paint Application:

- i. Supply specification of the paint is given in the end of the specification for various paints.
- ii. Mixing of the paint shall be carried out as per the manufacturer data sheet / instruction, using only compatible thinner.
- iii. Paint may be applied using Brush, air spray or airless spray techniques. The same shall be brought in the work procedure.
- iv. The painter shall be trained to measure each paint coating WFT corresponding to the specified DFT. Standardize the paint application technique to achieve the desired WFT and same shall be ensured in the qualification trial.
- v. The subsequent coat of paint shall not be applied as recommended by the paint manufacturer.
- vi. In case the drying time is abnormally higher than time specified by the manufacturer, the painting system and paint shall be reviewed for acceptance.
- vii. No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.
- viii. Any repair observed during inspection shall be attended by the contractor as per the procedure. Such repairs are not eligible for payment.

3.4 Inspection, Qualification:

- i. The grit blaster and painter engaged in work shall be assessed for skill and persons who have adequate technique only will be qualified.
- ii. During qualification of procedure the following test will be performed.
 - a. Wet film thickness (WFT).
 - b. Dry film thickness (DFT).
 - c. Peel off test.
 - d. Pull test.
- iii. During application only WFT and DFT will be done and based on DFT the work will be accepted.

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- iv. All material such as grit, primer, paint shall be checked for manufacturer test certificate (MTC) and date of manufacturing and expiry date. No material will be accepted without MTC.

4. Reports and records:

- i. The work of grit blasting and primer application is part of fabrication / supply & fabrication of metal structure / pipe support. No separate payment is envisaged for the same.
- ii. Painting shall be measured and paid as per respective BOQ item.
- iii. Records shall be made in the formats specified in the detailed quality plan.

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2.2.16 COLD INSULATION FOR EQUIPMENTS AND PIPELINES

CONTENTS

SR NO	DESCRIPTION
1	Purpose
2	Scope
3	Applicable codes & Standards
4	Design Requirement
5	Insulation material
5.1	Cold Insulating Layer
5.2	Covering Layer (Cladding)
5.3	Ancillary materials
6	Insulation Thickness
6.1	Pipe Insulation for Chilled Water System (water temperature 6 °C to 12 °C)
7	Application of Insulation
7.1	Application of Insulation over the Pipes and fittings
8	Application of covering layer (cladding)
9	Measurement of insulation
10	Examination and testing
11	Submission of Technical Documents

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1. PURPOSE:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during raw material, fabrication, installation and performance guarantee of Elastomeric closed cell Nitrile / EPDM foam Rubber Insulation for cold insulation of chilled water equipment & piping/ equipment, and valves in various systems of KKNPP 3&4.

2. SCOPE:

The scope of the contractor's work comprises but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection and inspection procedures.
- iii. Procurement of elastomeric foam - Nitrile rubber / EPDM insulation, conducting tests to meet technical requirements, supply to site, providing temporary storage, handling, transportation to site.
- iv. Supply, fabrication and erection of non metallic cladding (jacketing) sheet as per the technical specification.
- v. Supply and fixing ancillaries such as aluminium self adhesive tape, sealant, cleaning agents, non metallic screws etc. for completing the work.
- vi. Cleaning of pipes, dampers/ valves, equipment, associated specialties, hangers and supports.
- vii. Preparation and submission of reports concerning the quality assurance, progress and completion of work.
- viii. Preparation of as built diagram of insulation with bill of material and preparation & submission of Construction Completion Certificate (CCC).

3. APPLICABLE CODES & STANDARDS:

The manufacture and performance of thermal/ acoustic insulation material shall comply with all currently applicable safety codes and standards including those

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specified below. Nothing in this specification shall be construed to relieve insulation vendor of his responsibility. In particular, the insulation and application shall conform to the latest editions of all applicable codes/ standards including the following;

Codes	Title
EN14304	Thermal insulation products for building equipment and industrial installations - Factory made flexible elastomeric foam (FEF) products
ASTM C534-02	Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C177 - 13	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
ASTM C518 -17	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 1338	Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
ASTM D1667	Standard Specification for Flexible Cellular Materials—Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM C 1534	Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Adsorbing Liner for Duct Systems
ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM C692	Standard Test Method for Evaluating the Influence of Thermal Insulations on External Stress Corrosion Cracking Tendency of Austenitic Stainless Steel

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ASTM C871– 95	Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
ASTM C1071 - 16	Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM C795 – 08 (2013)	Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
BS EN 12667:2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance properties
BS EN 13469:2012	Standard Test Method for Evaluating the Influence of Thermal Insulations on External Stress Corrosion Cracking Tendency of Austenitic Stainless Steel
US EPA Method 5021a	United state environmental protection agency – method a - volatile organic compounds in various sample matrices using equilibrium headspace analysis
BS 476 Part 6	Fire Tests on Building Materials and Structures, Method of test for fire propagation for products
BS 476 Part 7	Fire Tests on Building Materials and Structures, Method for the Classification of the Surface Spread of Flames of Products.
ISO4892-2 Method A	Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps
ISO 846 Method A & Method C	Determining the deterioration of plastics due to the action of fungi, bacteria and soil organisms.

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In the event of any conflict between the provisions of this specification & the standards referred, the decision of the engineer shall be final.

4. DESIGN REQUIREMENTS:

Material and components used for thermal insulation layer must retain thermal, physical characteristics, and structure during the operation process and must meet the following requirements

- a) Capacity to function at the required temperature.
- b) Low thermal conductivity.
- c) Low water vapour permeability.
- d) Long life of insulating properties.
- e) Good mechanical strength (compressive strength), light weight, flexibility and resistant against tearing & and should have property of easy to wrap over pipe and other complex structures.
- f) Non-corrosive, vermin/ rodent proof, water repellent.
- g) Fire retardant/ self-extinguishing.
- h) Suitability in radiation field.
- i) It should not emit during operating process any hazardous, fire risk & explosive gaseous substance gaseous substance with objectionable odour in quantities exceeding the limiting concentration
- j) It should be bio-stable & don't emit during operating process any pathogenic bacteria, virus & fungi.
- k) It should be resistant to degradation.
- l) It should be UV resistant for indoor & outdoor facilities.
- m) It should be easy to install & repair.

5. INSULATION MATERIAL:

General cold insulating structure can consist of the following components:

- Cold insulating layer.

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- Steam insulating layer – in case of open cell insulation material (for cold insulation to prevent condensation of air)
- Covering layer – protective cladding for preventing mechanical damage and for providing UV resistance.
- Ancillaries - Reinforcing details, fasteners, adhesive tapes, glues for fixing of insulation and cladding over the surface to be insulated.

5.1 Cold Insulating Layer:

Following are the principle insulation (cold) materials with elastomeric Nitrile/EPDM rubber for different area of application;

- a) Elastomeric Closed Cell Nitrile foam Rubber/ EPDM rubber insulation is shall be used as a basic thermal insulation structure in case of cold insulation of chilled water piping & equipment.

The closed cell of elastomeric Nitrile/ EPDM foam rubber insulation eliminates the requirements of additional steam insulation layer in cold insulation structure which is required for preventing the wetting of the insulation structure if the surface condensation takes place. The basic properties of cold insulation material shall be meeting the parameters as given in Table-1:

Table-1: Basic parameters of cold insulation material:

Sl. No.	Parameter	Chilled water Pipe, Equipment
1.	Basic Material	Closed Cell Nitrile Rubber/ EPDM Insulation Class 'O' Fire category
2.	Density (kg/m ³) Maximum	45-75
3.	Maximum Thermal conductivity (W/m-K)	0.04 W/M-K at 22±5 deg C
4.	Sorption humidity % not by volume	0.5%
5.	Water vapour diffusion (μ) Min.	7000

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6.	Contents of watersoluble chlorides (by mass), % not more than	0.03
7.	Contents of free alkalis reduced to caustic soda (by mass), %, not more than	0.02
8.	Fire Performance	Class-I
9.	Flame propagation BS 476 Part 7 BS 476 Part 6;	Total Index Performance (I) ≤ 12 Sub Index (i1) ≤ 6
10.	Anti Microbial Properties/ resistance to Fungi	-
11.	Radiation Tolerance **	Shall not damage when exposed to 20 MRad
12.	Insulation make	Armaflex, K-flex, Aeroflex or equivalent

Note:- Fire performance test & anti microbial properties as per relevant standards shall be conducted and qualified for one sample of each manufacturer.

Radiation test shall be conducted for one sample of material for each manufacturer.

The material after subjecting the radiation test shall be subjected to visual examination, and there shall not be any physical damage in terms of appearance, decolouration, development of cracks, shrinkage/ swell in the volume.

5.2 Covering Layer (Cladding):

Covering material shall provide mechanical resistance against impact loading/ tear resistance. A 3 layered non-metallic cladding having aluminium as an intermediate layer and UV protection shall be used as the cladding material.

The basic properties of cladding material shall be as per Table-2:

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Table-2: Basic properties of covering layer;

Sl. No	Description	Properties
1	Basic material	3 layered non-metallic cladding having aluminium as an intermediate layer with metallic finish or equivalent material
2	Thickness	300 to 350 Micron thickness minimum
3	UV resistance	Yes as per ISO 4892-2 Method A/ASTM G154
4	Fire performance	Class 1 as per BS 476 Part 7 Class 'O' Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards
5	Resistance to mechanical impact	> 200 N as per ASTM D 4833-07.
6	Tensile strength	> 50 MPa as per ISO 527-1:1996 & ISO 527-3:1995
7	Elongation	>50 % as per ISO 527-1:1996 & ISO 527-3:1995.
8	Radiation Tolerance	Not less than 20 Mrad
9	Cladding make	Arma-Check Silver, K flex Al-Clad or equivalent

Note: a) The UV, radiation tolerance and fire performance of cladding shall be done for one sample for each manufacture.

5.3 Ancillary materials:

a) Specification for Adhesive :-

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Adhesive shall be used for bonding the seams securely together. Special Rubber based contact Adhesive free from benzene; specially formulated for the Piping insulation application and supplied by insulation manufacturer shall be used. The basic properties of adhesive shall be;

The adhesive material shall be compatible with the insulation as well as the primer/ finished paint applied over the pipeline and shall not cause any corrosion, damage to the base material.

- The adhesive shall have excellent bonding to porous and non porous surfaces. It is recommended to use the adhesive as specified by the insulation material manufacturer for ensuring compatibility with the material.
- Adhesive shall be in compliance with Indian Green Building requirement.
- The adhesive material shall be as recommended by the insulation manufacturer. The technical properties of adhesive used shall meet the technical requirements

Table-3: Technical Details of adhesive material

Sl No.	Properties	Description/ Range
1	Material	Rubber based contact adhesive in blend of solvents meet the requirements of MIL-A-24179A Amend-2, Type II, Class 1
2	Form	Liquid
3	Temperature Range	-25°C to +90°C
4	Drying Time	7-8 minutes
5	Viscosity @ 30°C	3500 - 4000 cps
6	Specific Gravity	0.89 - 0.92 g/cc
7	Flash Point	The adhesive shall have a flash point below minus 3.9 °C

Note: One sample test certificate for one manufacturer shall be submitted at the time of approval of material.

b) Silver aluminum based tape with self-adhesive:

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Silver aluminium based tape of minimum width 50 mm with self-adhesive ability to ensure 100% leak-proof joints. The tape shall be with a pre coated layer of solvent based adhesive which is non-hazardous in nature.

c) Fasteners:

The joints of the cladding sheet shall be secured with plastic rivets in the overlap area, installed every 200 mm along the material length.

6. INSULATION THICKNESS:

The basis for selection of insulation thicknesses of various operating temperatures and piping and equipment are given in the following table. Insulation thickness can be modified subject to approval of NPCIL. In general the thickness of insulation shall be followed as indicated below;

6.1 Pipe Insulation for Chilled Water System (water temperature 6 °C to 12 °C)

Pipe Size*(Nominal Diameter)	Insulation thickness (mm)
25 mm & below	32 mm
25 mm to 65 mm	38 mm
80 mm-160mm	44 mm
Above 160mm	50 mm
Pumps	50 mm thick

For Valves, bends, valves the same thickness shall be used as for the connected pipe sizes.

*Thickness of insulation is tentative and shall be followed in case of missing details in WDs. Final decision regarding required thickness of insulation is taken by EIC & that should be binding to the contractor.

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7. APPLICATION OF INSULATION:

Some important features of application procedure for insulation and other related items outlined in this specification are for the guidance of the Contractor. Detailed method statement for each type of job along with proposed Quality Plan shall be prepared by the contractor before executing the work at site. The insulation persons must have undergone training and the skill shall be evaluated by conducting mock-up test over the piping and fittings as agreed by engineer. Ensure proper tools, templates, instruments for measurements as recommended by insulation manufacturer are available before taking up the insulation work. It is not permitted to use makeshift tools for cutting and trimming of insulation. The ancillaries, adhesive used for fixing of insulation shall be of insulation manufacturer recommended make.

7.1 Application of Insulation over the Pipes and fittings:

Chilled water piping and accessory insulation application shall be as follows:

- a) Before applying insulation, all pipes shall be brushed and cleaned. All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc.
- b) Ensure that the hydro testing of piping network is completed and primer application is completed and are released for taking up insulation work.
- c) Insulating material in tube form shall be sleeved on the pipes.
- d) On erected piping, slit open tube of the insulating material (slit with tool recommended by manufacturer) and shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.
- e) Wherever flat sheets are used for insulation it shall be cut out in correct dimension considering the outer diameter (OD) of the insulated pipe thickness. All longitudinal and transverse joints shall be sealed with application of sealant as per manufacturer recommendations.
- f) The insulation shall be placed continuously over the entire run of piping, fittings and valves and no gaps are allowed.
- g) Adhesive shall be applied on both surfaces of the insulation seam joint.

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- h) The pipe bends and fittings shall be insulated first before carrying out the insulation of straight length of piping.
- i) On large radius bends, the insulation can be sleeved up and around the fitting. Always fix the seam on the centre of the pipe work and not along the “throat” or on the back off the bend. Once the seam is secure, the adhesive joint can be turned away from view.
- j) Care shall be taken up while fixing insulation on the bends, to avoid compression/ tension on glued seam joint.
- k) For large bore welded bends that are segmented, the shape of the welded segments can be chalked and transferred by insulation sheet be placed onto the fitting using the correct thickness of insulation. The chalked outline can be used as a template and transferred to metal or the boxes. Always keep to the correct dimensions.
- l) All valves, fittings, joints, strainers, etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is in operation.
- m) Ensure all exposed metal of the fittings is insulated to prevent condensation/ formation. In areas and locations that have exposed electrical equipment nearby, it is advised that the Valve Handle itself is also insulated with removable insulation fabrications.
- n) All the transverse and seam joints shall be covered with the adhesive seam tape of size as recommended by the manufacturer.

8. APPLICATION OF COVERING LAYER (CLADDING):

After completion of installation of thermal insulation, three layered non-metallic cladding having aluminium as an intermediate layer and UV protection shall be installed over the insulation. The cladding shall be adjoin tightly and free of gaps to the thermal insulating layer, be free of visual defects (dents, cracks, signs of corrosion).

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- a) Covering layer is assembled of individual components made in workshop. Dimensions of components are determined by assembly conditions.
- b) Components of covering layer should be fastened (non metallic screws/ rivets)/ glued with adhesive as recommended by manufacturer.
- c) The covering layer shall be mounted with 40...50 mm overlaps along longitudinal and transversal joints.
- d) On vertical facilities the covering layer is installed from the bottom upwards, on horizontal facilities the covering layer is installed in the direction opposite to declination.
- e) The covering layer (cladding) of cylindrical part of equipment shall be installed:
 - after installation of the covering layer of thermal insulating structure of bottoms of horizontal apparatuses;
 - after installation of the covering layer of thermal insulating structure of the lower bottom of vertical apparatuses;
- f) Covering layer (cladding) of straight sections of pipelines shall be mounted after installation of covering layer on thermal insulating structure of piping bends.
- g) Pitch between non metallic self-tapping screws shall be:
 - 150 mm for longitudinal joints between components of covering layer and lobes of spherical bottoms;
 - 300...350 mm for transversal joints between components of covering layer.
- h) For assembly of components of covering layer of thermal insulating structure of piping bends the two self-tapping screws are to be installed on a longitudinal joint of each section of the covering layer.
- i) Where projected parts (unions, hatches, man-holes, supports) penetrate the covering layer, the finishing linings made of the material of covering layer shall be installed.
- j) The aluminium adhesive tape shall be used for sealing the seam and transverse joints of cladding.

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9. MEASUREMENT OF INSULATION:

- a) Pipe Insulation shall be measured in units of length (Rm or Running Meter) along the centre line of the insulated pipe. The linear measurements shall be taken before the application of the insulation. For piping measurements, all valves, orifice plates and strainers shall be considered strictly by linear measurement along the centre line of the pipes, and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.
- b) Insulation of flanges associated with equipment (equipment and mating flange) and valves (flanged or screw-ended valves with flanged tail pipes) shall form part of the valve or equipment. The outer surface area of insulation box measured in square meter will be considered for payment.
- c) The equipments like valves, pumps etc. Shall be measured in square meter calculated over the surface of completed insulation over the cladding.
- d) The insulation of pipe supports, mountings will be measured in Square meter (Sq.m) calculated over the external surface of the insulation.

10. EXAMINATION & TESTING

All materials required for insulation, including jacketing and other finishing materials shall be new and subject to the approval of the NPCIL.

All the insulation material received at the plant site shall be stored in the batches properly identified. The Quality Plan (QAP) for material shall be submitted for approval of NPCIL prior to commencement of work. All test certificates providing the proof of the requirements shall be provided for each batch as per approved QAP. NPCIL has the right to ask for additional testing at no extra cost in order to satisfy himself, that the insulating materials fully meet the requirements.

The application of the insulation and finishing of the insulation work shall be of first class workmanship subject to the approval of the NPCIL.

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11. SUBMISSION OF TECHNICAL DOCUMENTS:

The following documents shall be submitted by the contractor for approval by NPCIL after placement of the order and before taking up the job

- Insulation application procedure in detail indicating step by step complete activities for each job
- Quality control/ detailed QAP and procedures indicating step by step complete quality control / inspection program at all stages of each job.
- Inspection and test procedures.

Approval of above technical documentation by NPCIL shall not relieve the contractor from full responsibility for correct interpretation of NPCIL specifications and drawing and for the completeness and accuracy of contractor's technical documentation. It shall be the total responsibility of the contractor to ensure that the product supplied and installed is in accordance with the governing specifications.

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2.2.17 SUPPLY AND APPLICATION OF HOT INSULATION USING CERAMIC BLANKET (FIXED & REMOVABLE) ON PIPING SYSTEMS AND EQUIPMENT

CONTENTS

Sr No	Description
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2	Scope
3	General Information
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5	Supply
6	Requirements of Ancillaries
6.1	Piping ancillaries
6.2	Equipment ancillaries
7	stitching
8	Application procedure
8.1	Surface preparation
8.2	Application of aluminum foil
8.3	Application of Insulation piping & equipment
8.4	Application of Multi-Layer Insulation
8.5	Application of Insulation on equipment
8.6	Application of Insulation on Piping Passing Through Wall/Slab Opening
9	Removable Insulation
10	Cleaning Requirement Of Building/ Rooms After Application Of Insulation And Health & Safety
11	Mode of Measurement
12	Examination And Testing
13	Reports and Records

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1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements involved in the supply and application of hot insulation & cladding over the process system piping and equipment covered under this contract.

2. Scope:

The scope of the contractor's work comprises but not limited to the following.

- i) Study of drawings, preparation of network schedules.
- ii) Preparation and approval of QAP, erection, welding and inspection procedures.
- iii) Supply, transportation, storage of ceramic fiber blanket of density 96 Kg/cum, glass cloth of 0.5 to 0.6 mm thickness of 600GSM, aluminum foil of 0.1 mm thick.
- iv) Supply, transportation, storage of stainless steel cladding sheets of 0.7mm thick conforming to ASTM SA 240, TP 304 mirror finish No 4 grade, stainless steel mesh of SS 304 and SS ancillaries for the systems inside reactor building and annular space.
- v) Supply, transportation, storage of aluminum cladding sheets of 0.8 mm thick and as per IS737, 19000H2 ancillaries for process systems of reactor safety & auxiliary buildings covered under this contract.
- vi) Handling, marking, cutting of mats & ceramic glass cloth to required lengths of required thickness and pre-forming of mats.
- vii) Cleaning of stainless steel pipe surface using acetone & application of aluminum foil on the stainless steel pipelines including cleaning of CS pipes.
- viii) Application of Hot insulation for CS and SS piping, piping elements, rotary and static equipments with fixed & removable type insulation in single & multilayer as per technical specification and working documents.
- ix) Marking, cutting and application of stainless steel wire mesh over the ceramic mats applied over the pipe lines. SS wire mesh application shall be applied over the systems inside reactor building.

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- x) Marking, cutting, forming, fabrication of Aluminum cladding for systems outside reactor building, Stainless steel cladding, SS wire mesh for systems inside Reactor building.
- xi) Erection of Cladding over the insulation, fastening the cladding sheets using the fasteners and as per the details given in the working drawing. And application of sealant over the joints of cladding.
- xii) Cleaning the work area from the insulation material and other waste generated through this work.

3. General information :

Hot insulation of piping system

a) Insulation of piping and equipment inside other than reactor building (group-2):

- Aluminum foils only on SS pipe lines.
- Ceramic insulation of thickness as indicated in drawing.
- Aluminum cladding

Application of thermal insulation shall be carried out after completion of the hydro test.

4. Design Basis:

- i) Hot insulation should be provided for external surfaces of equipment, pipes, valves and supports with following coolant temperature:
 - Above plus 45 deg C located in the full accessible and control accessible attended rooms.
 - Above plus 60 deg C located in unattended rooms.
- ii) For Indoor facilities when ambient temperature is plus 25 deg C, temperature on surface of insulation should not exceed the following.
 - Plus 45 deg C for facilities located in the permanently attended rooms,
 - Plus 60 deg C for facilities located in the periodically attended rooms,

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iii) For outdoors facilities within the service areas, the temperature on the surface of insulation should not exceed:

- Plus 55 deg C for the covering metallic layers
- Plus 60 deg C for other kinds of covering layers

5. Supply

i) Supply of raw material: Supply of material includes ceramic insulation mats as per the specification mentioned below, fastening elements, supporting elements, sealing elements etc.

ii) Supply of ceramic insulation mats:

For thermal insulation of stationary equipments, SS and CS piping sewn mats made of superfine basalt fiber/ ceramic fiber blanket wrapped in glass fabric confirming to the properties mentioned in Tables 1 shall be used.

Table 1

Thermal Insulating material for Vibrating equipment, Valves, Tank, manhole, flanged joints and weld joints (selected) where removable type insulation is proposed		
SI No	Parameters for thermal insulating material	Value for Ceramic Fiber blankets
1	Density of article, Kg/cum, (average)	96
2	Compaction factor during erection	1.2
3	Heat conductivity, W/(m deg C) at (22±5) deg C not greater than	0.04
4	Calculated head conductivity in the structure, W/m deg C	$\lambda_k = (0.035 + 0.00017 \cdot t_m)^*$
5	Sorption humidity, % not greater than	0.5

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6	Radiation tolerance (cumulative irradiation dose), Mrads, not less than	100
7	Content of water soluble chlorides (by mass) % not greater than	0.03
8	Content of free alkalis reduced to caustic soda (by mass) % not greater than	0.02
9	Content of non fibrous impurities	0 (Particles having the same composition as the fiber are not considered as impurities)
10	Average diameter of fiber (micro meter) not greater than	3.0
11	Application for temperature not greater than deg C	600
	*T _m = (t _w +45)/2-average temperature of thermal insulating layer deg C, where t _w -coolant temperature deg C	

Note:

- 1) For thermal insulation for equipment, pipeline with coolant temperatures above 250°C (indicative only), multiple layer thermal insulating structure required and also outer layer seams must overlap the inner seams. However, thickness of insulation is indicated in insulation WDs and the same has to be followed.
- 2) Single layer of insulation thickness is limited to maximum of 50 mm only. Each layer of insulation shall be wrapped in glass cloth & stitched.
- 3) CS pipe and supports shall be painted before application of insulation.
- 4) The contractor shall qualify the insulation material for parameters specified in table above.

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iii) Supply of cladding:

- a) Stainless steel cladding sheets of 0.7mm thick conforming to SA 240, TP 304 mirror finish No 4 grade.
- b) Supply Aluminum cladding sheets of 0.8 mm thick conforming to IS7372008, 19000H2 grade and ancillaries for reactor auxiliary buildings covered under this contract.
- c) Supply of Aluminum foil 0.1mm thick for required width and length conforming to IS737-2008.

iv) Supply of ancillaries:

- a) Insulation ancillaries include Shelf supports, ring supports, clamping rings, yokes, pin bushings, clamping wire rings, wire suspensions and bracing wires, SS wire meshes, metal shroud etc.
- b) Scope includes supply of these ancillaries, in case required shape is not readily available in the market, the same shall be fabricated.
- c) Material of construction of the ancillaries shall be of carbon steel or stainless steel based on the material of pipe line and equipment.

6. Requirements of ancillaries:

6.1 Piping ancillaries:

- i. Thermal insulating structures must rule out deformation and sliding down of thermal insulating layer throughout service life.
- ii. Shelf supports, ring supports, clamping rings, yokes, pin bushings, clamping wire rings, wire suspensions and bracing wires, wire meshes, metal shroud are used as support devices, reinforcing details and fasteners of the thermal insulating layer and thermal insulating structure. Typical arrangement of insulation on piping is shown below.
- iii. Support devices (shelf supports with metal sheet diaphragms on them) should be designed through 2000mm / suitable pitches on vertical sections of pipe lines with

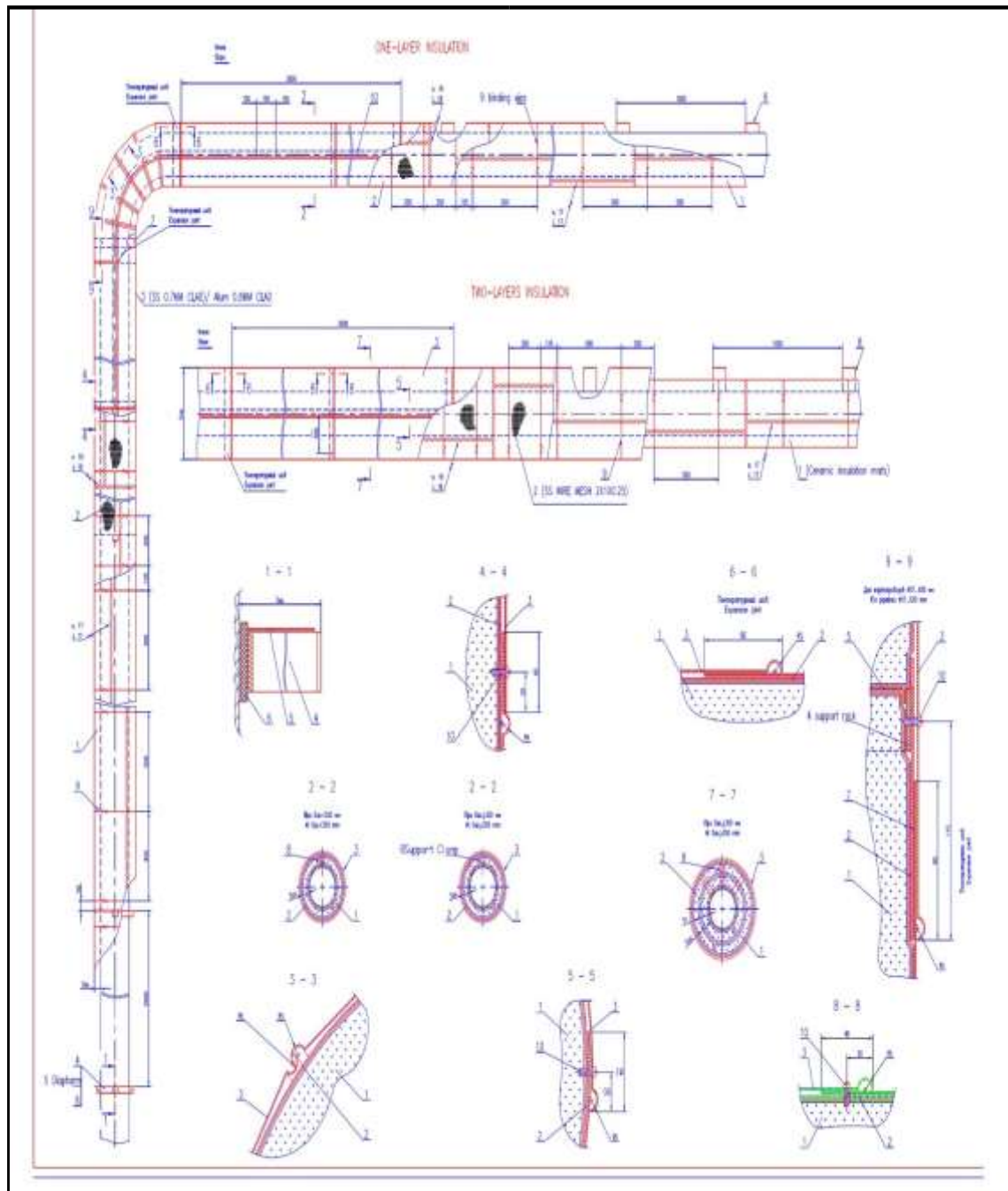
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diameter of 57 mm and larger when insulation is 40 mm and larger and on vertical equipment.

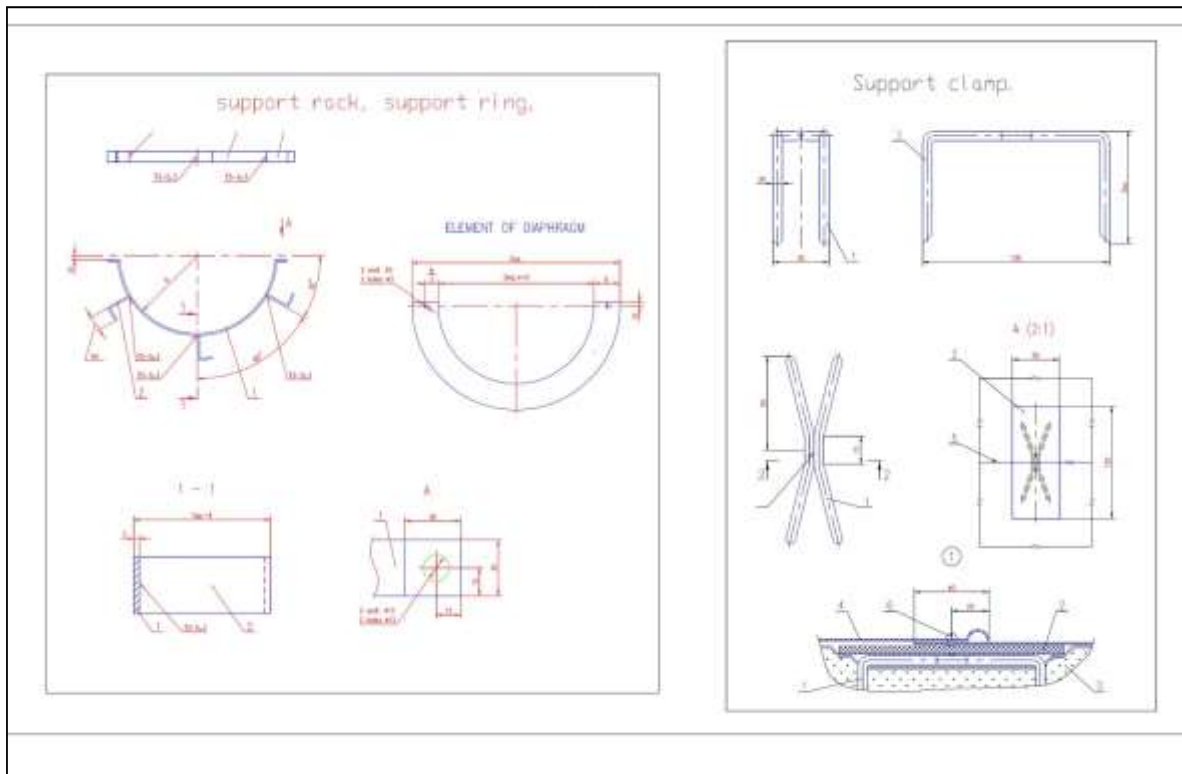
- iv. Support devices (ring support) should be designed through 2000mm / suitable pitches on horizontal sections of pipe lines with diameter 630mm and larger when insulation is 80 mm and larger and on vertical equipment.
- v. Support devices should be designed through 1000mm suitable pitches on horizontal sections of pipe lines with diameter of 108 mm and larger; support yokes one in section if outer diameter of thermal insulation is 350 mm and less, three in section if outer diameter of thermal insulation is greater than 350mm. It is not allowed to install support yokes in place where ring supports are installed.
- vi. In order to preclude occurrence of direct thermal bridges, the space fillers (made of thermal insulating card board/ ceramic paper) are installed between the surface and shelf supports and ring supports as well as between support yoke and covering layer of thermal insulating structure.

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- vii. Typical arrangement of insulation on pipelines with necessary ancillaries is shown in the sketches given below.



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6.2 Equipment ancillaries:

- i. Thermal insulation is fixed on equipment with outer diameter of housing of 1200 mm and larger by wire pins with diameter of 5mm or as specified in drawing.
- ii. Pin for fixing thermal insulation on equipment;
 - Inserted in yoke or bushing welded to housing of equipment.
 - Pins are welded to the frame made of metal tapes or stripes, which are welded to shelf supports or ring support and fastened by clamping rings installed between shelf supports along the length and vertical extent of equipments each 1000 mm,
 - Pins may be permitted to be welded directly to housing of equipment, if it is specified by equipment supplier / specification.
 - Frame made of metal tapes or strips is mounted after installation of equipment in the designed position.

Fixing of such fastening of pins over the surface of equipment is included in the scope of work.
- iii. Pins for fastening of thermal insulation on cylindrical part of equipment are located;

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- on vertical equipments horizontally through 500 mm pitches, vertically through 250 mm pitches
 - on horizontal equipments horizontally through 250 mm pitches, vertically through 500 mm pitch.
- iv. Pins are located on top bottom of vertical equipments and bottoms of horizontal equipments in concentric circles through 500 mm pitches circularly; pins are located on lower bottoms of vertical equipments in concentric circles through 250 mm pitches circularly.
- v. Pins are located on top bottoms of vertical equipments and bottoms of horizontal equipments with radial distance 500 mm between concentric circles, on lower bottom of vertical equipments pins are located with radial distance 330 mm between concentric circles.
- vi. Thermal insulation is fastened on equipment and pipe lines with outer diameter less than 1200 mm by bracing wires.
- vii. Bracing wires are woven with wire of diameter 1.2 ... 2 mm up to thickness of insulation. For single layer insulation, the bracing wires are woven of four wires, for double layer insulation of six wires.
- viii. Bracing wires are fastened to surface of equipment with ring made of wires 2 mm in diameter.
- ix. Wire rings are installed on cylindrical parts of equipment at 500mm pitches along the length and vertical extent of equipment as well as along both parts of shelf supports and ring supports.
- x. Wire rings are installed on bottoms of equipments in the shape of concentric circles through a distance of 500 mm between them.
- xi. Wire rings on cylindrical parts of vertical equipment to be fixed in the required position are interlace with wire strings with diameter of 2 mm, which are located through 1000 mm pitch along the circle.
- xii. Wire strings on bottoms of horizontal equipments are installed through 500mm pitch along the circle and are fastened to rings supports. Wire strings on bottoms of vertical

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equipment are installed through 1000mm pitch along the circle, not less than three of them evenly located along circle and are fastened to shelf support.

- xiii. Support devices, reinforcing elements and fasteners of thermal insulating structure should be designed of steel, grade of which corresponds with the insulated surface, with which they contact.
- xiv. Support devices, reinforcing elements and fasteners of thermal insulating structure made of carbon steel are subject to corrosion protection.

Note: All supporting devices, reinforcing elements and fasteners of thermal insulating structure to be used on stainless steel piping and equipment shall be made from stainless steel material confirming to ASTM A240 Type 304.

All supporting devices, reinforcing elements and fasteners of thermal insulating structure to be used on carbon steel piping and equipment shall be made from carbon steel material confirming to IS 2062 with epoxy primer & paint of NPCIL approved brand.

[illegible]

7. Stitching of ceramic fiber mats:

- i. The insulation supplied for various thicknesses shall be wrapped around layer wise using glass cloth and to be stitched at end also stitching in lengthwise in between as given in table.
- ii. As sewing material for thermal insulation articles (sewn mats) the glass threads, silica threads or roving are used.

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- iii. Wrapping fabric used on thermal insulation articles must not have coarse defects (be cut or frayed).
- iv. Articles must be needled by threads or roving lengthwise.
- v. Sewing parameters are provided by performance by sewing machine as given below in table.

Parameters	value
1. Number of stitches on article; • 500 mm wide , pcs , not less than • 1000mm wide, pcs, not less than	3 6
2. Pitch of stitch, mm , not greater than	120
3. Space from edge of article to stitch, mm	40

8. APPLICATION PROCEDURE:

Some important features of application procedure for insulation and other related items out lined in this specification are for guidance of the contractor. Detailed procedure for each type of job along with proposed quality plan shall be prepared by the contractor based on information provided on each working drawings and shall be submitted for approval. The above documents require acceptance/ approval of the Engineer before commencement of any insulation work. The Contractor shall submit installation procedures for each type of insulation for acceptance by the Engineer-in-charge and carry out work as per drawings.

8.1 Surface Preparation:

- a) The term “cleaning” used in the specification means that the surfaces to insulated shall be made free of all loose scale rust, grease, dust, oil or any other foreign matter. The surfaces thus cleaned shall be thoroughly dried before proceeding with any insulation work. All material and tools required for cleaning shall be arranged by CONTRACTOR within the quoted rate of insulation work.

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- b) For cleaning of stainless steel surfaces using acetone or any other equivalent. All cleaning agents shall be subject to the prior approval of Engineer.
- c) For cleaning carbon steel surfaces DM water shall be used (DM water shall be issued as free issue).

8.2 Application of aluminum foil:

Aluminum foil of 0.1mm thick shall be applied over the cleaned surface of stainless steel pipes and fittings before proceeding for insulation. The aluminum foil shall be fixed with the aluminum adhesive tape or any other alternative with prior approval from engineer.

8.3 Application of Insulation piping & equipment:

a) Application of single layer insulation:

- Cleaning of surface of piping as described above and acceptance by Engineer.
- Supply and of 10 SWG CS / SS (1.2mm to 2mm) bracing wires around the surface of the surface at 250-350mm mm center to center and drawing CS painted 20 SWG loops from the 10 SWG wires at 300mm distance for holding the blanket insulation. Incase pins are installed than same is not required.
- Supply, fabrication and fixing CS / SS spacer ring fabricated out of flat 25x3 confirming to IS 2062 / SS 304. The CS fabricated spacer shall be grid blasted and applied one coat of zinc anode 304 primer and one coat of paint. The spacer shall be fixed with L type lugs. Asbestos mill board shall be used between pipe/equipment and lugs of spacer ring to avoid heat conduction.
- The ceramic fibre blanket wrapped around by using glass fibre cloth at shop shall be applied on piping, valves, equipment etc., including supports. The single layer permitted is only 50mm thickness and less.
- Ceramic fibre blanket wrapping shall be carried out in a such way that no gap between the joints of blanket.
- The blankets shall be impaled over the 20 SWG GI / SS wires and extra length of wire loops shall be bent and inserted into the insulation.

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- After installation the thermal insulating articles must adjoin tightly to the insulated surface and be compacted down to the designed thickness.
- Wires projected from insulation (by 50 mm) are to be bent at the level of the surface of thermal insulating layer and are to be deepened into the thermal insulating layer so that they would not project out of the exterior of insulation.
- Laying insulation wrapped around by silica fabric or glass fabric, joints between mats to be sewn together with glass threads with diameter of 0.6-0.8 mm.
- When pinning the fibre articles to surfaces, the rings made of wire with diameter of 2 mm or shrouds made of tapes 0.7...0.8 x 20 mm are to be additionally installed along the exterior of insulation and tied to pins as specified in the working drawings.

b) Outer protective cover (cladding).

- Marking, cutting and pre-fabricating of aluminum / SS cladding / SS wire mesh at contractor shop, Handling and shifting of the pre-fabricated cladding to the site as per the requirement on day to day basis. Material shall not dumped at work location at once.
- Wrapping the SS wire mesh (for SS piping inside reactor building & annular space) and fixing using SS wire of 20 SWG.
- Wrapping of Aluminum / stainless steel cladding over the surface, fastening cladding with pan head self-tapping size No. 8, length 12 to 18mm. Spacing of aluminum / SS screws
- shall be suitable for close fit up, but not over a pitch distance of 100-150 mm. Joints of the cladding shall be overlapped up to 30 – 50 mm.
- Vapor barrier or sealing compound shall be applied all around joints of the cladding sheet.

8.4 Application of Multi-Layer Insulation:

- The sequence specified for single layer shall be followed in general in addition, on multi layers insulation both longitudinal and circumferential joints of outer layer shall be staggered with respect to those of inner layer.

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- The number of CS / SS loop wire shall be selected for multilayer. The first (interior) thermal insulating layer is to be fastened by tying of two-four bracing wires; the second (exterior) thermal insulating layer is to be fastened by tying of four-six bracing wires. Ends of bracing wires are to be twisted and deepened into the thermal insulating layer.
- The spacer ring size shall be selected for thickness of insulation.
- Steel band made of SS of size 12mm x 0.5mm thick shall be used to secure the insulation.
- Each layer of ceramic fiber blanket shall be wrapped around by using glass fiber cloth at shop.

8.5 Application of Insulation on equipment:

- a) No aluminium foil to be installed on equipment.
- b) Prior to application of insulation over the equipment, dowel for holding insulation in position and retainer rings (support rings) shall be welding over the body of the equipment.
- c) Scope of work includes welding of these dowel pins and support rings.
- d) On completion of the supporting arrangement, application of single layer and multilayer insulation with cladding for all equipment shall be done as described as explained above for piping.

8.6 Application of Insulation on Piping Passing through Wall/Slab Opening:

- a) Wall opening required 50mm more from the insulation thickness all around. The same will be covered with flashings.
- b) Self-tapping ½" x No. 8 aluminium screws shall be utilized for holding the cladding sheet in position at a pitch distance of 150 mm.

9. Removable Insulation:

- i. Equipment and component such as pumps, valves, orifices and areas which are subjected to regular inspection as part of in-service inspection (ISI) are to be insulated using a removable type thermal insulation for both carbon steel and stainless steel piping and equipment.

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- ii. Before proceeding for insulation, development drawing of the outer counter of the component shall be made and pre-fabrication of cladding shall be made to suit the counter in multiple pieces which shall be attached to one another using the latches.
 - iii. Fixing of latches can be made using fastening screws or spot welding method.
 - iv. Detailed methodology for development of removable type insulation considering the latest practice available in use, shall be made and submitted to BHEL & NPCIL for approval.
10. Cleaning Requirement of Building/ Rooms After Application of Insulation and Health & Safety:
- i. During insulation and after completing insulation, the insulation debris, loose parts shall be collected in metal container on day to day basis and accumulated debris, metal scrape shall be shifted to dumping yard on weekly basis leaving work place.
 - ii. Loose particle shall be cleaned by means of Vacuum Cleaner on daily basis.
 - iii. Identified, separate and trained manpower shall be engaged in cleaning work.
 - iv. Lapses in cleaning of work place will result in stoppage of work and holding/ deduction of payments due to the contractor.
 - v. All staff and working personnel shall be provided with health protective gear such as mask, hand gloves etc.,
 - vi. Persons employed in insulation work shall be qualified, skilled, and trained.
 - vii. Personnel protective equipment and gears shall be used.

11. Mode of Measurement:

The unit of measurement for hot insulation is in square meter. It will be measured over the outer diameter of the pipe line / fitting / valves & equipment.

Note: No standard guide lines will be followed for measurement.

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12. Examination and Testing:

- a) Material required for thermal insulation, including jacketing, insulation supporting devices and other finishing materials shall be new and subjected to the approval of the Purchaser.
- b) Insulation material received at the plant site shall be stored in batches properly identified. The Quality Plan (QAP) for material shall be submitted for approval of Purchaser prior to commencement of work. All test certificates providing the proof of meeting technical requirements shall be provided for each batch as per approved QAP. Purchaser has the right to ask for additional testing at no extra cost in order to satisfy himself, that the insulating materials fully meet the technical requirements of the specification.
- c) The application of the insulation and finishing of the insulation work shall be of first class workmanship subject to the approval of the Purchaser.
- d) Thermal conductivity test of ceramic fiber blanket shall be carried out at NPCIL approved reputed Institute such as IIT Chennai, CBR Rookie and other Govt. approved laboratories only.
- e) The balance test as specified in QAPs, Indian and Russian standards shall be conducted at approved reputed test labs. Bidder will carry out all testing and inspection within the quoted rate of insulation. No separate payment will be made to the contractor on this account.
- f) The Contractor shall test at no extra cost the samples as per the above specification and prove that the materials being used is meet all requirements of this specification.
- g) Insulation material shall be tested for Gamma radiation to a dose of 100M RADS according to USP XXI 1985 and BP11-1988 at radiation plant for sterilization of medical product (board of radiation and isotope technology department of Atomic Energy) or at reputed lab as approved by NPCIL. Post irradiation examination shall also include visual examination and condition for usability of insulation.

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13. Reports and Records:

- i. Reports shall be prepared as per the requirements and the formats mentioned in the QAP and the working drawings.
- ii. Erection reports and as built information shall be prepared and submitted for acceptance of the Engineer.

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2.2.18 SHIFTING, ERECTION, ASSEMBLY, WELDING OF INCINERATOR INCLUDING HANDLING, CUTTING, LAYING REFRACTORY INSULATION FOR INCINERATOR IN RADIO ACTIVE WASTE PROCESSING AND STORAGE BUILDING

CONTENTS

Sr No	Description
1	Purpose
2	Scope
3	General information and Erection:
3.1	General information
3.2	Handling and Erection
3.3	Refractory insulation
4	Reports and Records

1. Purpose:

Purpose of this specification is to provide guidance to contractor to understand the scope, quantum of work and technical requirements to be followed during handling, assembly, erection & fit up, welding and erection of refractory insulation for the diesel fired incinerator in radioactive waste processing and storage building.

2. Scope:

The scope of the contractor's work comprises but not limited to the following.

- i. Study of drawings, preparation of network schedules.
- ii. Preparation and approval of QAP, erection & assembly, welding and inspection procedures.

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- iii. Receipt of free issue material such as refractory insulation bricks, cement filler (for mortar preparation), kaowool paper, ceraborad from NPCIL store, preparation of IMIR, depreservation, procedures etc.
- iv. Site survey for supporting metal structure and supplied equipment dimensions.
- v. Handling, shifting, erection of individual parts of incinerator.
- vi. Assembly, fit up and welding of individual parts of incinerator.
- vii. Taking profile and field measurements of the incinerator, preparation of layout.
- viii. Trial assembly of bricks, cutting bricks to dimensions as per layout.
- ix. Erection of refractory bricks, filling gaps with the ceramic insulation, kaowool paper, cera boards, mixing and application of mortar to required thickness and dimension as per drawing & specification.
- x. Preparation and submission of reports for acceptance for incinerator in UKS.

3. General information and Erection:

3.1 General information:

- i. KPH is a system for burning the solid radioactive waste before preceding it for cementation. This system mainly consists of diesel furnace (2nos) with auto feed mechanisms. These furnaces are located in UKS building (solid radioactive waste storage building) at elevation +4.80m on floor as well as metal structure.)
- ii. These furnaces are provided with refractory insulation on the inner side, refractory insulation is supplied in brick form, where individual bricks shall be collected from the NPCIL stores.

3.2 Handling and Erection:

- i. Parts of incinerator in radioactive waste processing building will be supplied in individual parts such as
 - a. Burning chamber.
 - b. Loading device.

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- c. Supporting gates.
- d. Churning comb.
- e. Transition piece.
- f. Re-burning chamber.
- g. Accessories such as ignition nozzles, viewing nozzles etc.
- ii. Survey shall be made for the availability of the metal structure, check the dimensions of the metal for matching with the incinerator components. In case any interferences for shifting and erection of the components, supporting metal structure may require dismantling and reassembling.
- iii. Handling, shifting of components in sequential manner as per the approved procedure and methodology.
- iv. Assembling of individual components using fasteners supplied.
- v. Transition chamber between the burning chamber and the re-burning chamber will be supplied excess length. Required length shall be determined as per the site condition, cutting excess length, assembling the chamber, fit up and welding.
- vi. Handling, shifting and assembly of lower and upper swinging gates along with comb with all accessories.

3.3 Refractory Insulation:

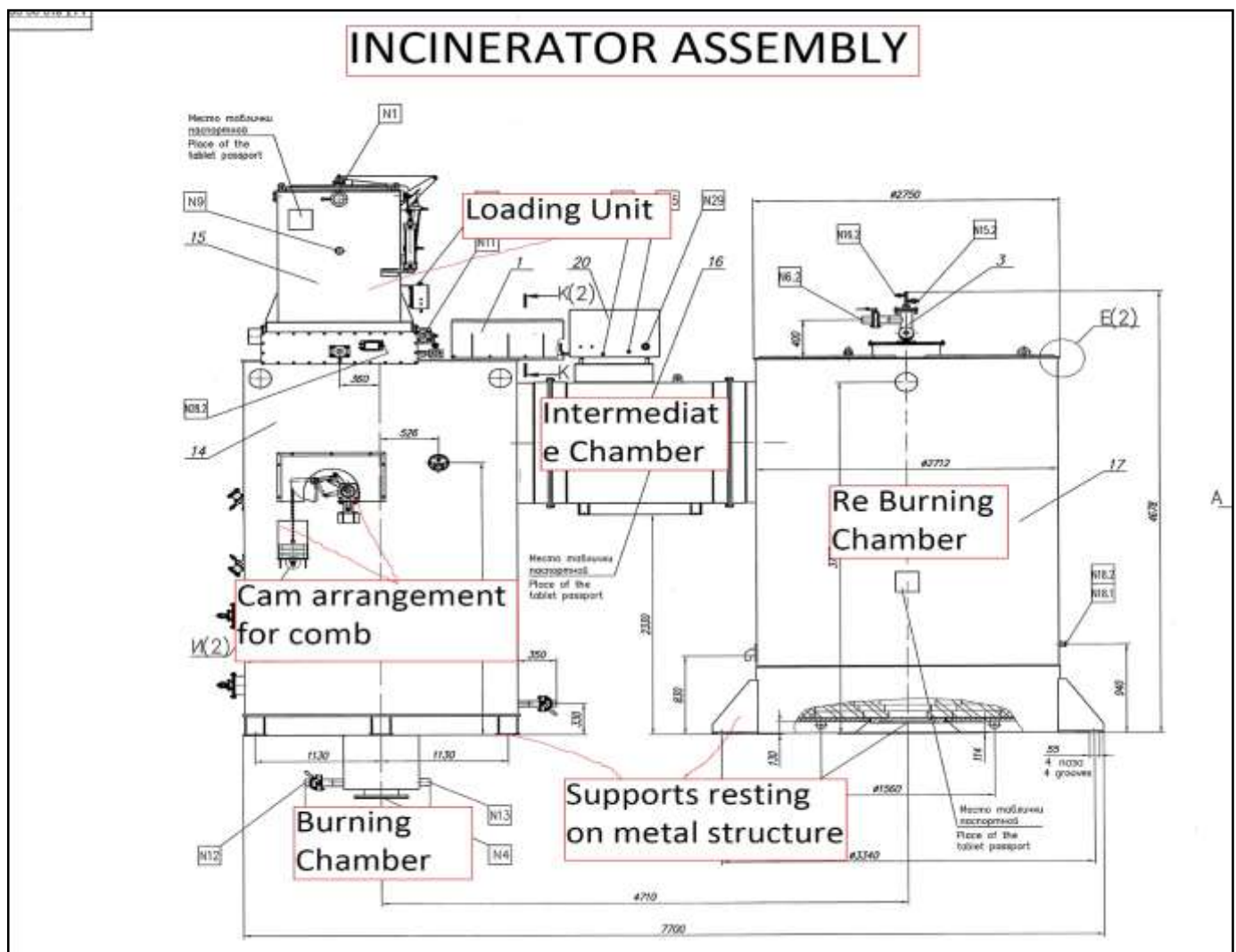
- i. On completion of equipment assembly and erection of parts of incinerator, refractory insulation application of shall be carried out.
- ii. Refractory bricks and the mortar will be supplied on the free issue basis.
- iii. Based on the measurements, marking and cutting of the bricks shall be carried out to suit the profile of the furnace.

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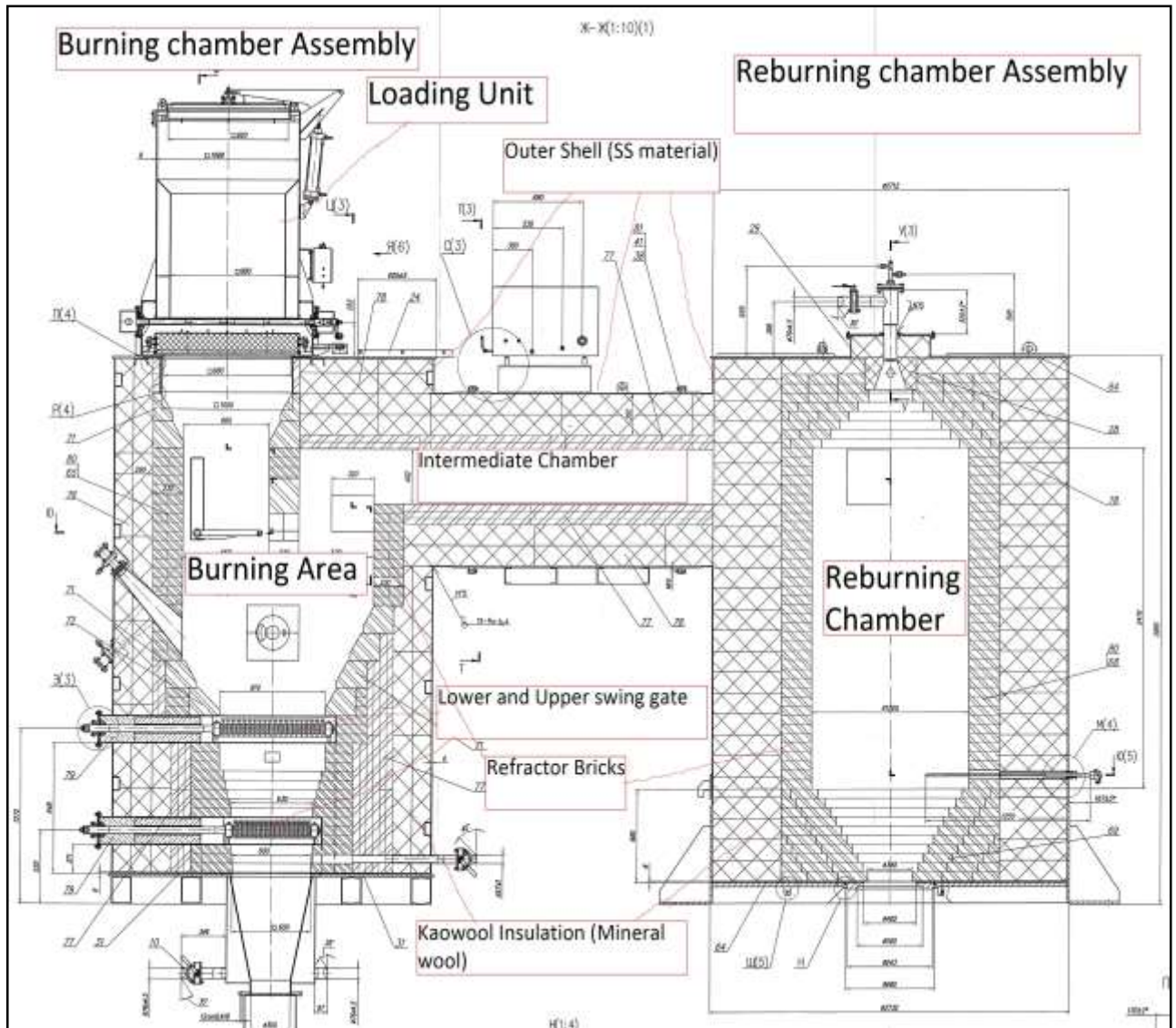
- iv. Once the brick cutting is completed, mortar mixing shall be carried out as per the working drawings and manufacture instruction.
- v. Mixing of mortar shall be carried out using proper Muller. Viscosity of the mortar shall be measured and ensured so that it matches the drawing requirement / manufacturer instruction.
- vi. Bricks shall be placed in position so that 3mm gap shall be maintained between the adjacent bricks. Mortar shall be filled in this gap.
- vii. There shall be uniform gap maintained between the metal wall of the furnace and the refractory bricks. In this gap KAOWOOL paper shall be filled as per the requirements stated in the working drawings in a sequential manner. KAOWOOL paper will be supplied on the free issue basis.
- viii. The above activities shall be carried out layer by layer, after reaching certain height, erection of scaffolding or any other stage arrangement shall be carried out to carry out insulation at higher elevation.
- ix. Top and the bottom of the furnace is completely covered, only man holes are provided to access the inside space of the furnace.
- x. Working inside is very congested and confined. Bidder shall take necessary precautions and safety measures with required permits to carry out the work inside the furnace. Fresh air supply arrangement shall be provided inside the furnace to facilitate conducive working condition and same shall be arranged by the contractor within the quoted rate.
- xi. Based on the location inside the furnace, all the bricks are numbered and identified. These identified bricks shall be installed only in the respective location. No interchangeability is accepted.

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- xii. Where ever doors, shutters are provided, these shall be provided with CERA board type insulation. Cutting these boards to the required dimension is included in the scope of work.
- xiii. After completion of the refractory insulation in the burning chamber and the re-burner, the same shall be tested for leak proof at air pressure of 2kPa.
- xiv. During execution of brick work there may be work to be carried out on the equipment which involves grinding, cutting and welding etc. The same is included in the scope of this work.
- xv. Typical arrangement of the furnace is given in the sketch below



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4. Records and Reports:

- i. Reports for the executed work shall be prepared and submitted for acceptance after completion of work along with necessary as built.

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2.2.19 BUILDINGS AND SYSTEM DESCRIPTION

1. Buildings and System description provided for general information & understanding purpose only.

1.1 Introduction:

In KKNPP all the Structures, Systems and Components (SSC's) are identified by a Unique non language based coding system known as KRAFTWERK KENNEZEICHEN SYSTEM (KKS). All the working documentations, drawings, technical specifications and other technical related documents issued to the contractor from time to time shall refer to these KKS codes. Complete list of KKS codes is available with Engineer In-charge which shall be made available to the Contractor on demand at the time of start of the work. For easy understanding, the descriptions of KKS codes of all the systems and structures which are part of this work were mentioned in various sections of this tender.

It is the responsibility of the contractor to train his personnel in understanding the KKS codes. The non-familiarity or ignorance of KKS coding system will not relieve the contractor from his responsibility of successfully performing the said work.

1.2 Major buildings/structures:

Major buildings covered under this contract are Reactor safety building (UKA/UKB/UJE); Reactor Auxiliary building (UKC/UCA), Fresh fuel storage building (UFC), Solid radioactive building (UKS). Brief description about each building is given as below.

1.2.1 Reactor Safety system Basement Building (UKA) & Ancillary systems Lean-to Building (UKB):

- i. UKA houses safety system and safety support system pumps, tanks, heat exchangers, blow down filters, associated piping, valves etc. Piping from this building will connect to the reactor building through hermetic penetrations.

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- ii. UKA is a two story underground building having floor elevations at -7.200m elevation, -4.250m elevation and +0.000m elevation. This basement is partitioned into four channels (trains) which are physically separated by concrete walls
- iii. UKB building houses equipment of radioactive gas filtering system and reactor annular space exhaust ventilation including UKA building exhaust ventilation systems.

1.2.2 Steam chamber building (UJE):

- i. Steam chamber houses steam pipelines, feed water pipelines and respective isolation valves of dia 600NB and 400NB. Also houses steam generator pulse safety device, BRU-A for relieving the over pressure of the steam generator and steam line.
- ii. These valves includes Fast acting steam isolation valves (4nos) each for each train and each valve weighing approx 6.5MT.
- iii. Building starts from +0.000m elevation to +22.000m elevation. Where the subject pipelines will be accommodated from +12.00m elevation to 22.00m elevation. Steam chamber also provided with louvers for releasing over pressure in the steam chamber in case of any emergency.

1.2.3 Reactor Auxiliary and Main control room Building (UKC) & The Normal Operation building of control system (UCA)

- i. Reactor Auxiliary Building is box type reinforced concrete structure of approximate size of 45 m by 72 m in plan and is approximately 31 m high.
- ii. The building has two levels of basement at elevation – 8.000 m and -3.600 m levels and above ground storey at elevations 0.000, +3.600 m, +7.200m, +10.800 m, +14.400 m, +18.000 m, +20.400 m, +24.600 m and 27.6 00 m. The UKC building contains normal operation water systems, liquid waste processing systems and control room at higher elevation.
- iii. UKC houses various equipments such as tanks, pumps, piping, and valves of huge number of auxiliary systems including liquid radioactive waste management

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systems. Also it houses various ventilation systems for supply and purification of air from and to reactor building.

1.2.4 Fresh fuel storage Building (UFC):

- i. As name indicates this building is used for receiving and storing the fresh fuel assemblies.
- ii. This building houses various racks for storing the fresh fuel assemblies, turner assembly etc.
- iii. This building is provided with two gates on either side of the building, one is of swinging type and other is of sliding type. Also consists of a hatch for providing access to the fresh fuel assemblies.

1.2.5 Solid Radioactive waste reprocessing and storage building (UKS)

- i. Solid radioactive waste building is rectangular building from +0.00m elevation to +22.000M
- ii. This building houses various equipments such as tanks, heat exchangers, hydraulic press, furnaces, diesel handling system, associated piping, valves etc.
- iii. The main purpose of the building is to process the solid radioactive waste collected from other buildings, those collected waste were burned and cemented as a blocks for long term storage.

1.3 System Description:

The brief description & important parameters of the main systems & the equipments are described below for information. The detailed parameters & requirement of pipeline, equipment for erection purpose would be provided in working documents to be issued in phased manner during construction. Only main system and equipment description have been included for general information of contractor

- ### 1.3.1 Safety systems:
- Safety systems are provided to mitigate the consequences of an accident situation. These systems actuate on the basis of signals from primary side or secondary side. Engineered safety systems are either active systems or passive systems. All the active systems are provided with a redundancy of 4x100% and

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passive systems are with 4x33%. Safety classification of the elements of the systems is based on Russian standards.

Sr No	KKS CODE	System Description	System Details	Building
1	JDJ	Quick boron injection system	A passive system of 4x33% redundancy for supplying the concentrated solution of boric acid into the primary circuit under ATWS condition. This system is connected to main coolant piping along with a tank storing boron solution with 40gm/Ltr concentration across the reactor coolant pump. So that during any ATWS condition, if RCP trips the total boron solution in the tanks will be pumped to the reactor by the cost down flow of the reactor coolant pump. The total piping network of the system is of stainless steel.	UJA
2	JKM	System for retention & cooling of reactor molten core	This systems is for confining liquid and solid fragments of destroyed core, reactor pressure vessel parts and vessel internals during hypothetical accidents, connected with core melting. System consists of various equipments such as core catcher, basket with filler, truss cantilever, lower plate etc for fulfilling the said purpose. In addition to this for providing the cooling for extended hours these equipments are provided with piping network extending to outside the reactor building for passing the coolant to the required location using external pumps such as fire tenders etc. The total piping network is of stainless steel and spread in UJA and annulus space (UJB)	UJA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

3	JMN	Containment Spray system	This is an active system with 4 X 100% capacity, main purpose is to reduce the parameters (pressure and temperature) inside primary containment and fixing of radioactive iodine within containment after LOCA. Two numbers of sprinkler headers above +50.00m elevation fixed to the reactor building dome with 2X 25 number of sprinkler nozzles for spraying the boron solution into the reactor building. The pumps for the system are located inside the UKA at -4.200m elevation. The sprinkled water is collected into the core catcher sump and further taken back to UKA for cooling via JNA heat exchanger which is a common cooling heat exchanger for all the active safety systems.	UKA,UJA
4	JMT	Hydrogen suppression inside the containment system	To avoid the formation of the explosive mixtures inside accident localization area by maintaining the volumetric hydrogen concentration in the mixture below the safety criteria thus protecting the elements of the localizing safety systems to ensure the containment leak tightness, integrity and availability of other LSS under operating conditions, and in accidents, including beyond design basis accident. Hydrogen recombiners are installed at various locations in containment. There are 157 such hydrogen recombiners which are located in some strategic locations inside the reactor building for fulfilling the purpose.	UJA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

5	JNA	Emergency & planned primary circuit cooling & fuel pool cooling system.	The purpose of the system is for reactor plant shutdown cooling when heat removal through steam generators becomes less effective, to remove residual heat from fuel in the cooling pond and from reactor and maintaining coolant inventory in the reactor and introducing chemicals for fixing radioactive iodine (JNA-80) to primary coolant during loss of coolant accidents. This is an active system with 4 X 100% redundancy where the pumps and Heat exchangers are located below containment (UKA) at -4.200m elevation. System piping is connected to JNG10-40, JEC(main coolant piping) at elevation approx +20.000m, fuel pool, core catcher sump inside reactor building. Piping from UKA enter the reactor building through floor vertical hermetic penetrations. Total piping in this system is of stainless steel of various sizes ranging from 15NB to 600NB.	UJA, UKA
6	JNB10-40	Emergency SG cooling and blow down system	This is an active system with 4 X 100% redundancy, purpose is to remove reactor core residual heat and cool down reactor plant by cooling steam generator steam in emergency situations and supplying steam generators blow down water for its purification and return to steam generators in normal operation mode. Pumps and heat exchanger are located below containment (UKA) at -4.200m elevation and 0.00m elevation. This system also operates along with LCQ10-40 for blow down of steam generator during normal operation of the reactor.	UJA, UKA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

7	JNB 50-90	Passive heat removal system	Passive heat removal system is a passive system whose purpose is to remove residual heat from the reactor core during beyond design basis accident (BDBA) with loss of alternate current power supply sources both in conditions of intact primary circuit, and in cases of leaks in primary or secondary circuit. This is 4 X33% redundancy , In case of primary circuit leak, system operates together with stage II ECCS hydro accumulators. This system takes steam from the steam generator during station black out and is cooled by air heat exchangers which are located outside containment at elevation +43.00 m. The condensate is returned back to steam generator. Connections between the steam generator and the heat exchanger is connected with piping network of carbon steel and stainless steel.	UJA
8	JND10-40	HP emergency injection system	This is an active safety system with 4X100 % redundancy whose purpose is to restoring primary circuit coolant losses and removing heat from the core primary circuit at high pressure in case of LOCA and maintaining of the reactor core in sub critical state. Pumps are located below containment (UKA)at -4.200m elevation. This system share heat exchanger of JNA for cooling. System is connected to MCP inside reactor building through stainless steel piping network from UKA to UJA entering through vertical floor hermetic penetrations.	UJA, UKA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

9	JND 50-80)	Emergency boron injection system	This is an active safety system with 4 X 50% capacity whose purpose is to Pump the boron solution into the pressurizer during primary to secondary side leakage inside the SG to reduce pressure in the primary circuit and provides core sub criticality during failure of a reactor control and protection system to operate during demand (ATWS). For fulfilling the said functions piping network is connected to the main coolant piping, pressuriser inside reactor building and Pumps are located below containment. (UKA)at -4.200m elevation. The material of construction of the system is stainless steel.	UKA,UJA
10	JNG10-40	Emergency core cooling system stage -1	Emergency core cooling system stage-I, is a passive system for cooling the reactor during emergency conditions. System consist of pressurized accumulator (4X60Cum) at +31.70m elevation of reactor building. Accumulators are pressurized with nitrogen gas. Accumulators are connected to the reactor directly by piping of Dia 355mm x 40mm through a series of check valves and gate valves. Also JNG 10-40 system piping is connected to other safety systems such as JNG50-80 & JNA. (explained in later parts). Accumulator is connected with the makeup & drain line. Also the system is provided with a special valves called pulse safety device to protect the tank from getting over pressurized.	UJA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

11	JNG50-80	2nd stage accumulator system (supplementary passive core flooding system)	This is a Passive safety system with 4 X33% capacity whose purpose is to supply of boron solution into the reactor core at low pressure by gravity to remove residual heat and to maintain the core sub criticality state during primary circuit leak with station blackout and for storing borated water reserves for filling reactor vault and vessel internals region in shut down condition of unit during refueling. System consists of 2X4 160Cum stainless steel accumulators (details covered in respective technical specification) tanks are located inside containment at +31.700m elevation. Accumulators are connected to main coolant piping with stainless steel piping network, valves and other accessories.	UJA

1.3.2 Auxiliary Systems:

There are several systems that are provided for normal operation of reactor to maintain water chemistry of reactor coolant, provide cooling media to various heat exchangers and to maintain other related function of reactor system. Brief description & function of systems are given below: -

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sr No	KKS CODE	System Description and Details	Building
1	FKA	This system consists of CPS drives decontamination bathes (FKA20BB001,FKA30BB001)with electric pump of CPS drive units decontamination baths (FKT20AP001,FKT30AP001) and decontamination compartment (washing tank) of ISTPS (Inter station Transport Packing Set)FKA50BB001 and its associated pipelines and valves for delivery of decontaminating solutions for decontamination of equipment and rooms in buildings UJA, UJB, UKA, UKB and UKC in order to reduce personnel radiation doses during NPP operation prior to scheduled-preventive maintenance and inspections.	UJA, UKC
2	FKT	This system consists of potassium permagnet preparation tanks (FKT10BB001) with electric mixer (FKT10AM001), Acids (Oxalic acid)solutions preparation tank (FKT30BB001) with electric mixer (FKT30AM001), Decontamination solution preparation tanks (FKT40BB001,FKT50BB001) with electric mixers (FKT40AM001) & (FKT50AM001), Decontamination solution supply pumps FKT40AP001, FKT40AP002, FKT50AP001, FKT50AP002, Plate type heat exchangers (Heaters)FKT40AC001,FKT50AC001,FKT60AC001 to maintain the temperature of decontamination solutions at the level of 90 degree Celsius located at various elevation within the UKC, Reducing and cooling facility (RCF)FKT21AA201 and FKT22AA201 are located in UJY gallery. For preparation and supply of decontaminating solutions for equipment decontamination and rooms before preventive maintenance	UKC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		and inspections for the purpose of reducing exposure doses to maintenance personnel in a process of NPP operation.	
3	GMN	This is Exhaust system for instrumentation compartment & compartment of secondary circuit emergency cooling down	UJA,UKC
4	JEA (50-90)	This system monitors the level in the Steam generator, steam humidity including steam generator flushing.	UJA, UKC
5	JET	This system is designed for reactor coolant controlled leak.	UJA
6	KAA	Component cooling system function is to remove the heat from the process systems, safety systems and ventilation systems and transfer the load to the ultimate heat sink. This system pumps and heat exchangers are located in -4.200m elevation at UKA . System consists of stainless steel piping of various sizes ranging from Dia 600NB to 10NB. System take care of loads in UKA i.e. travels throughout UKA, enters the reactor building through floor hermetic penetrations at +5.40m elevation. KAA system travels throughout reactor building from +5.40m elevation +40m elevation, to take care of various loads such as ventilation , reactor coolant pump etc. Also	UJA, UKC, UKA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		system enters UKC to cater the loads of ventilation and other process systems.	
7	KBA	System is for full filling the function of feed and bleed requirements of primary circuit. Also system is intended for maintaining the primary circuit chemistry with the help of other systems such as KPJ , KBB (chemical reagents preparation system, storage system etc). System mainly consists of 3 nos of centrifugal pumps at -3.600m elevation & heat exchangers , after coolers +9.000m and de-aerator at + 18.000 m elevation of UKC . System consists of stainless steel piping with major diameter of piping 125NB and minimum diameter of 10NB. This system piping erected in UKC, UJA/UJB and having connection with other process systems.	UJA, UKC
8	KBB	For receiving, storing and supplying coolant for treatment in various unit operation modes with purpose of receiving clean condensate and boron concentrate for repeated use in NPP cycle for primary circuit makeup.	UKC
9	KBC10-30	For bubbler filling and makeup, boron washing, makeup of nuclear component cooling system, distillate supply to suction of hydro tests pumps	UJA, UKC
10	KBC40-60	Providing maintenance of water-chemical regime quality of primary circuit makeup water in accordance with regulations requirements to primary circuit, from the aspect of controlling reactor core reactivity during fueling campaigns by boric acid.	UKC
11	KBC-70	System is used for testing and calibration of control rods and protection drive. System consists of a reciprocating pump located inside annulus space at +9.000m elevation. Stainless	UJA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		steel piping 10NB enters the reactor building through inner containment hermetic penetration and travels throughout RB at various elevations and connects to vertical stand area near inspection well.	
12	KBD	For maintaining water-chemical regime of primary coolant in accordance with requirements to primary circuit of NPP with ensuring minimal radioactive contamination and minimal corrosion rate of structural materials of reactor plant equipment.	UKC
13	KBE (10-40)	Continuous purification of the primary coolant to remove dispersive corrosion particles in structural materials of the primary circuit with the purpose to reduce sedimentation of these particles in the coolant and decrease radiation impact on personnel	UJA
14	KBE (50-60)	Removing chemical impurities of structural materials, corrosion products and radio nuclides, which are in ion form, in order to ensure coolant quality within standardized range during the whole campaign.	UKC
15	KBF	For processing boron-containing water with purpose of receiving clean condensate for primary circuit makeup and boron concentrate for repeated use in NPP cycle.	UKC
16	KLB 50-80	To ventilate annulus space and discharge air after filtration	UJA
17	KPJ	The reagent preparation and supply system used for conducting periodical washing drain water treatment system, coolant treatment system evaporating units, filling hydro accumulators of coolant storage systems.	UKC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

18	KTA	Collecting drains of water containing boron within reactor building boundary, receiving and pumping the coolant through low-temperature coolant purification system filters at primary circuit low pressure, drains collecting during repair works. System consists of stainless steel piping of size ranging from 100NB to 10NB , valves a, supports. In addition to this system consists of heat exchanger inside the reactor building at +9.000m elevation and enter UKC at +9.000m elevation. System travels throughout the reactor building to collect the organized drains from the primer circuit. Major part of the piping is of small bore piping.	UJA, UKC
19	KTB	Dilution of gas blow-offs by nitrogen down to explosion-safe concentrations in primary circuit equipment and transporting of gas blow-offs into radioactive process blow-offs cleaning system KPM; Diluting and transporting hydrogen at outlet from chemical and volume control deaerator to system for burning hydrogen from radioactive process blow-offs KPL.	UJA, UKC
20	KTC (10-20)	This system deals with collection of boron containing water from Reactor Related system	UKC
21	KTC 50	This system deals with drains from reactor auxiliary system	UJA
22	KTC (60-70)	This system is for drain and air removal from active water treatment plant	UKC
23	KTF	All active drains are collected and disposed by this system	UJA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

24	KTH	To collect drains of the special drain self-flowing system of UJA & UKC bldg and supply them for treatment and also for prevention of contaminated water transportation to the free access area.	UKC,UJA
25	KTN	This system is connected with active drainage pipe work system of UKC building	UKC
26	KTP	The system pipelines connect the upper points of the reactor cover, pressurizer and SG collectors via the shut-off valves units by means of the common pipeline of 76x7 mm. For removal of steam-gas mixture from the primary coolant circuit and decrease of pressure in PRZ in combination with PRZ PSD for the purpose of decreasing consequences under design- basis accidents and beyond design-basis accidents. The piping are located within containment.	UJA
27	KUA (10-50)	Automatic monitoring of boric acid concentration in accordance with requirements of reactor plant systems.	UJA, UKC
28	KUA (60-80)	For taking samples of primary coolant and the fuel pool water and obtaining online information about the status of water chemistry in the reactor coolant system.	UKC
29	KUE	Sampling system	UKC
30	KWA	Hydro testing of bubbler with the purpose to test its strength and leak tightness and blowdown of I&C sensors with distillate.	UJA, UKC
31	KWB50	KWB50 system is meant for hydro testing of the secondary circuit. system consists of stainless steel piping with pressurizing pump , fittings and valves. Pumps of KWB50 system are located at UKC -3.600m elevation and enters the	UJA, UKC

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		reactor building (UJA) through outer and inner containment and travels through out reactor building and connected to the secondary circuit. System consists of small bore piping with fittings, valves, pumps, flow orifices etc.	
32	KWC	Hydro testing of the primary circuit pipelines, ECCS of the first stage & second stage with the purpose to test their strength and leak-tightness and blow down of I&C sensors with feed water of the primary circuit and boron solution.	UJA, UKC
33	LAB	Feed water supply to the steam generators to provide their required steam capacity in the modes of the normal operation and in the modes of the disturbed operation. System consists of piping from steam generator at +26.000m elevation inside reactor building, from steam generator piping enters the UJE at approx +20.000m through hermetic penetration of bellow compensator type. System mainly consists of carbon steel piping of Dia 400NB, valves and visco elastic dampers. From UJE system enters the turbine building from +12.00m elevation.	UJA UJE
34	LBA	Live steam supplying steam to Turbine starts from the steam generator headers at +29.500m elevation and travels from reactor building to the UJE (steam chamber) through inner containment hermetic bellow type penetration. From steam chamber system piping will enter the turbine building at elevation +12.000m. System consists of carbon steel piping of size 600NB, series of valves and pipe supports. System also consists of fast action steam isolation valves which is weighing	UJA UJE

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		around 6000kg. System also has visco elastic dampers which are to be erected along with the pipe supports.	
35	LCM80-90LBG (10-70)	This system deals with steam line and other equipment in connection with Auxiliary steam line	UJA, UKC, UKS
36	LCM80-90LBG (10-70)	This system deals with collection and disposal of drain in the Turbine hall and other areas.	UKC
37	LCQ (10-LCP)	This system deals with de-mineralised water supply.	UKC
38	LCQ (10-LCP)	To maintain secondary circuit water-chemistry regime.	UJA, UKC
39	LCQ (50-80)	Continuous purification of SG blow down water at high-temperature mechanical and low-temperature ion-exchanging filters in order to assure blow down water quality within limits of standardized values during the whole campaign.	UKC,UKA
40	LFG	For chemical flush of the steam generators.	UJA, UKC
41	QUJ	This system deals with checking of leak tightness of joints in the steam generator	UJA
42	QUK	For sampling and monitoring the chemistry of SG blow down water.	UKC
43	QUH	This system is connected with sampling of secondary cycle and condensate polishing equipment.	UJA, UKC
44	SRG 50	Checks radioactivity of the controlled access area	UKC

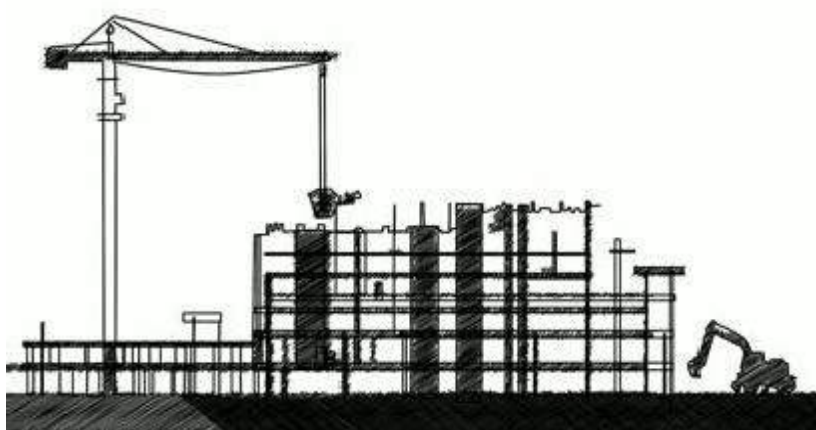
TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.3.3 Fuel handling systems:

- i. Fuel handling system includes systems for handling fresh fuel and spent fuel. Fresh fuel storage will be done in UFC building (explained in the previous sections). Whereas systems for handling spent fuel are located inside the Reactor building.
- ii. Fuel handling systems include refueling machine, fuel pool racks, fuel transport cask, decontamination pit, shock absorber, defective fuel detection system etc.
- iii. Fuel pool is used for storage of the spent fuel, in which stainless steel racks are provided for holding the spent fuel assemblies. Fuel pool is filled with borated water upto elevation 30.7m elevation all the time.
- iv. Refueling machine is used for handling the fuel assemblies during unloading and loading during refueling activities.

1.3.4 Waste management systems:

- i. Waste management system includes solid radioactive waste management system and liquid radioactive waste management system.
- ii. Solid waste will be processed in UKC and UKS buildings, whereas liquid waste will be processed in UKC and processed waste will be shifted to UKS for further processing.
- iii. All these waste management systems include various equipment such as pumps, piping, cementation units, solid waste burning furnaces, hydraulic cutter and press for compacting waste, conveyers for transferring the waste from one location to another etc.



HEALTH, SAFETY and ENVIRONMENT PLAN

for

**SITE
OPERATIONS**

by

**SUB-
CONTRACTORS**

POWER SECTOR

HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START	SIGNING OF MOU	
	Agree to comply to HSE requirement- Statutory and BHEL’s	
PLAN	HSE ORGANISATION	
	Manpower 1 (one) safety officer for every 500 workers or part thereof 1(one) safety-steward/ supervisor for every 100 workers Qualification As per Cl. 7.1	HSE Roles and responsibilities - Site In-charge- As per clause 7.2.1 - Safety officer- As per clause 7.2.2
	HSE Planning for Man, Machinery/Equipment/Tools & Tackles	
PROVIDE	HSE INFRASTRUCTURE	
	- PPEs - Drinking Water - Washing Facilities - Latrines and Urinals - Provision of shelter for rest - Medical facilities	- Canteen facilities - Labour Colony - Emergency Vehicle - Pest Control - Scrapyard - Illumination
TRAIN	HSE TRAINING , AWARENESS & PROMOTION	
	Training - Induction training - Height work and other critical areas - Tool Box talk & Pep Talk	Awareness & Promotion - Signage - Poster - Banner - Competition - Awards
COMMUNICATE	HSE COMMUNICATION	
	Incident Reporting - Accident- Fatal & Major - Property damage - Near Miss	Event Reporting - Celebrations - Training - Medical camp

EXECUTE SAFELY

OPERATIONAL CONTROL PROCEDURES

PERMIT TO WORK

Height work (above 2 metres), Hot Work, Heavy Lifting, Confined Space, Radiography, excavation (More than 4 metres)

SAFETY DURING WORK EXECUTION

• Welding • Rigging • Cylinder- storage & Movement • Demolition work • T&Ps • Chemical Handling • Electrical works	• Fire • Scaffolding • Height work • Working Platform • Excavation • Ladder • Lifting • Hoisting appliance

HOUSE KEEPING

WASTE MANGEMENT

TRAFFIC MANAGEMENT

ENVIRONMENTAL CONTROL

EMERGENCY PREPAREDNESS AND RESPONSE PLAN

CHECKS

HSE AUDITS & INSPECTION

• Daily Checks • Inspection of PPEs • Inspection of T& Ps • Inspection of Cranes & Winches	• Inspection of Height work • Inspection of Welding and Gas cutting • Inspection of elevators etc.

HSE PERFORMANCE EVALUATION PARAMETERS

NON CONFORMANCE

PENALTY for NON CONFORMANCE

Refer Clause 16

Incremental penalty

For repeated violation by the same person, the penalty would be double of the previous penalty

For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS		Doc no.: HSEP: 14
	POWER SECTOR		REV: 01
			Date: 20.01.2020

REVISION HISTORY SHEET

Date	Revision No.	Details of Changes	Reason	Prepared	Reviewed	Approved
12.08.2014	00	First Issue	First Issue	S. B. Jayant, Dy Manager- FQA & Safety	A. K. Sinha, GM-FQA & Safety	Anuj Bhatnagar, ED-FQA & Safety
20.01.2020	01	Formats added: HSEP:14-F30 – Monthly HSE Planning & Review (Page 11, Clause 8.0 - updated) HSEP:14-F13E-Excavation Inspection Format (part of F30)) HSEP:14-F32B – Job Safety Analysis Format (part of F30) HSEP:14-F31A – Daily HSE Reporting (Page 18, Clause 10.3 – added) HSEP:14-F33 – HSE Performance Evaluation (Page 31, Clause 13 – revised)	IOM No. PSHQHSE/M ONREP/02 Dated 08-Jan-2020	Rohit Kumar	Santosh Nair, GM (MSX & HSE)	



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1.0 PURPOSE

- 1.1** The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.
- 1.2** This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents.
- 1.3** Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy relevant statutory guidelines must be followed.
- 1.4** In case the customer has any specific requirement, the same is to be fulfilled.

2.0 SCOPE

The document is applicable for BHEL's Subcontractors at all installation / servicing activities of BHEL Power Sector as per the relevant contractual obligations.

3.0 OBJECTIVES AND TARGETS

The HSE Plan reflects that BHEL places high priority upon the Occupational Health, Safety and Environment at workplaces.

- Ensure the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment of the work site.
- Comply at all times with the relevant statutory and contractual HSE requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision on the safety aspect of their work.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including subcontractors in respects of HSE.
- Establish effective communication on HSE matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps/Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent person.
- Ensure timely provision of resources to facilitate effective implementation of HSE requirements.
- Ensure continual improvements in HSE performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.



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HSE TARGETS

EXPLOSION	ZERO
FATALITY	ZERO
LOST TIME INJURY	ZERO
FIRE	ZERO
VEHICLE INCIDENTS	ZERO
ENVIRONMENTAL INCIDENTS	ZERO

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Health, Safety & Environment Policy of BHEL

In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

sd/-

CMD, BHEL

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5.0 MEMORANDUM OF UNDERSTANDING:

After award of work, subcontractors are required to enter into a memorandum of understanding as given below:

Memorandum of Understanding

BHEL, Power Sector _____ Region is committed to Health, Safety and Environment Policy (HSE Policy).

M/s _____ do hereby also commit to comply with the same HSE Policy while executing the Contract Number _____

M/s _____ shall ensure that safe work practices as per the HSE plan. Spirit and content therein shall be reached to all workers and supervisors for compliance.

In addition to this, M/S _____ shall comply to all applicable statutory and regulatory requirements which are in force in the place of project and any special requirement specified in the contract document of the principal customer.

M/s _____ shall co-operate in HSE audits/inspections conducted by BHEL /customer/ third party and ensure to close any non-conformity observed/reported within prescribed time limit.

Signed by authorized representative of M/s -----

Name :

Place & Date:



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6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

Work- related or natural event(s) in which an injury, or ill health (regardless of severity), damage to property or fatality occurred, or could have occurred.

6.1.2 NEAR MISS

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as "Near-Miss".

6.1.3 MAN-HOURS WORKED

The total number of man hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labours. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workdays for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

6.1.4 FIRST AID CASES

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time.

6.1.5 LOST TIME INJURY

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

6.1.6 MEDICAL CASES

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:

An incident, where the injured person is given medical help and discharged for work without counting any lost time.



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Reportable Cases:

In this case the injured person is disable for 48 hours or more and is not able to perform his duty.

Injury Cases:

These are covered under the heading of non-reportable cases. In these cases the incident caused injury to the person, but he still continues his duty.

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

$$\frac{\text{Number of Reportable LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

6.1.9 SEVERITY RATE

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

$$\frac{\text{Days lost due to LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

6.1.10 INCIDENCE RATE

Incidence Rate is the Number of LTI per one thousand manpower deployed. Mathematically, the formula reads as:

$$\frac{\text{Number of LTI} \times 1000}{\text{Average number of manpower deployed}}$$

7.0 HSE ORGANISATION

Number of safety officers:

The subcontractor must deploy one safety officer for every 500 workers or part thereof in each package. In addition, there must be one safety-steward/safety-supervisor for every 100 workers.

Deployment: The subcontractor should deploy sufficient safety officers and safety-steward/Safety-supervisor, as per requirement given above, since initial stage and add more in proportion to the added strength in work force. Any delay in deployment will attract a penalty of Rs.30,000/- per man month for the delayed period.

7.1 QUALIFICATION FOR HSE PERSONNEL

Sl.no	Designation	Qualification	Experience
1	Safety officer (Construction Agency)	Degree or Diploma in Engineering with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years for degree holder and five years for diploma holder in the field of Construction of power plant/ major industries

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2	Safety-Steward/ Safety-Supervisor	Degree or diploma in any discipline with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years

7.2 RESPONSIBILITIES

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

- Shall sign Memorandum of Understanding (MoU) for compliance to BHEL's HSE Plan for Site Operations as per clause 5.0
- Shall engage qualified safety officer(s) and steward (s) as per clause 7.0
- Shall adhere to the rules and regulations mentioned in this code, practice very strictly in his area of work in consultation with his concerned engineer and the safety coordinator.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like safety helmets, belts, full body harness, shoes, face shield, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in Factory Rule Regulation R57.
- Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent person.
- Shall ensure that provisions stipulated in contract Labour Regulation Act 1970, Chapter V C.9, canteen, rest rooms/washing facilities to contracted employees at site.
- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs) available with the site management.
- Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.
- Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /HSE officer of BHEL.
- Shall ensure that Horseplay is strictly forbidden.
- Shall ensure that adequate illumination is arranged during night work.
- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of HSE audit, mockdrill, medical camps, induction training and training on HSE at site.
- Shall ensure full co-operation during HQ/External /Customer HSE audits.



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- ☐ Shall ensure submission of look-ahead plan for procurement of HSE equipment's and PPEs as per work schedule.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the worksite.
- Shall ensure availability of sufficient number of toilets /restrooms and adequate drinking water at work site and labour colony.
- Shall ensure adequate emergency preparedness.
- Shall be member of site HSE committee and attend all meetings of the committee
- Power source for hand lamps shall be maximum of 24 v.
- ☐ Temporary fencing should be done for open edges if Hand – railings and Toe-guards are not available.

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, P&M and other tools and tackles.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Help concerned HOS to prepare Job Specific instructions for critical jobs.
- Conduct investigation of all incident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of HSE permit systems, OCPs & MPs.
- Convene HSE meeting & minute the proceeding for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Report to PS Region/HQ on all matters pertaining to status of safety and promotional program at site level.
- Facilitate administration of First Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire Drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- ☐ Apprise PS– Region on safety related problems.
- Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge, immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.
- Shall work as interface between various agencies such customer, package-in-charges, subcontractors on HSE matters

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8.0 PLANNING BY SUBCONTRACTOR

Monthly planning and review of HSE activities shall be carried out by subcontractor as per format No. HSEP:14-F30 jointly along with BHEL.

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.
- The machinery and equipment to be embraced for this purpose shall include but not limited to the following:
 - o Mobile cranes.
 - o Side Booms.
 - o Forklifts.
 - o Grinding machine.
 - o Drilling machine.
 - o Air compressors.
 - o Welding machine.
 - o Generator sets.
 - o Dump Trucks.
 - o Excavators.
 - o Dozers
 - o Grit Blasting Equipment.
 - o Hand tools.
- Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

- The subcontractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by a registered medical practitioner.
- The subcontractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job.
- Ensure that the regulatory requirements of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.
- Appropriate accommodation to be arranged for all workmen in hygienic condition.



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8.3 PROVISION OF PPEs

- Personnel Protective Equipment (PPEs), in adequate numbers, will be made available at site & their regular use by all concerned will be ensured
- The following matrix recommends usage of minimum PPEs against the respective job.

Sl. No	Type of work	PPEs
1	Concrete and asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves, nose mask and ear muffs if noise level exceeds 90dB. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Ear muffs, safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Respiratory mask, Hand gloves, safety goggles
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, respirator, leather gloves
8	Painting	Plastic gloves, Respirators (particularly for spray painting)
9	Radiography	As per BARC guidelines

- The PPEs shall conform to the relevant standards as below and bear ISI mark.

Relevant is-codes for personal protection

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 6994 – 1973 (Part-I)	Industrial Safety Gloves (Leather & Cotton Gloves).
IS: 1989 – 1986 (Part-I-II)	Leather safety boots and shoes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 6519 – 1971	Code of practice for selection, care and repair of Safety footwear.
IS: 11226 – 1985	Leather Safety footwear having direct molding sole.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 1179-1967	Eye & Face protection during welding
IS: 3521 – 1983	Industrial Safety Belts and Harness
IS: 8519 -1977	Guide for selection of industrial Safety equipment for body protection
IS: 9473-2002, 14166-1994, 14746-1999	Respiratory Protective Devices

The list is not exhaustive. The safety officer may demand additional PPEs based on specific requirement.



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- Where workers are employed in sewers and manholes, which are in use, the subcontractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent incident to the public
- Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall use Helmet and any other PPEs as deemed appropriate for the area of work.

Colour scheme for Helmets:

1. Workmen: Yellow
 2. Safety staff: Green or white with green band
 3. Electrician: Red
 4. Others including visitors: White
- All the PPEs shall be checked for its quality before issue and the same shall be periodically checked. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced.
 - The issuing agency shall maintain register for issue and receipt of PPEs.
 - The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front.
 - The body harnesses shall be serial numbered.

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

- Drinking water shall be provided and maintained at suitable places at different elevations.
- Container should be labeled as " Drinking Water"
- Cleaning of the storage tank shall be ensured atleast once in 3 months indicating date of cleaning and next due date.
- Potability of water should be tested as per IS10500 at least once in a year.

8.4.2 WASHING FACILITIES

- In every workplace, adequate and suitable facilities for washing shall be provided and maintained.
- Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.
- Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

8.4.3 LATRINES AND URINALS

- Latrines and urinals shall be provided in every work place.
- Urinals shall also be provided at different elevations.
- They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
- Separate facilities shall be provided for the use of male and female worker if any.

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8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

8.4.5.1 MEDICAL CENTRE (As per Schedule V, X and XI of BOCW central Rules, 1998)

- A medical centre shall be ensured/identified at site with basic facilities for handling medical emergencies. The medical center can be jointly developed on proportionate sharing basis with permission from BHEL
- A qualified medical professional, not less than MBBS, shall be deployed at the medical centre
- The medical centre shall be equipped with one ambulance, with trained driver and oxygen cylinder.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

8.4.5.2 FIRST AIDER

- Ensure availability of Qualified First-aider throughout the working hours.
- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of Qualified first aiders and their contact numbers should be displayed at conspicuous places.

8.4.5.3 FIRST AID BOX (as per schedule III of BOCW)

- The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
- The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
- The first aid box shall be distinctly marked with a Green Cross on white background.
- Details of contents of first aid box is given in Annexure No. 01
- Monthly inspection of First Aid Box shall be carried out by the owner as per format no. HSEP:14-F01
- The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

8.4.5.4 HEALTH CHECK UP (As per schedule VII and Form XI)

The persons engaged at the site shall undergo health checkup as per the format no. HSEP:14-F02 before induction. The persons engaged in the following works shall undergo health checkup at least once in a year:

- a. Height workers
- b. Drivers/crane operators/riggers



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- c. Confined space workers
- d. Shot/sand blaster
- e. Welding and NDE personnel

8.4.6 PROVISION OF CANTEEN FACILITY

- Canteen facilities shall be provided for the workmen of the project inside the project site.
- Proper cleaning and hygienic condition shall be maintained.
- Proper care should be taken to prevent biological contamination.
- Adequate drinking water should be available at canteen.
- Fire extinguisher shall be provided inside canteen.
- Regular health check-up and medication to the canteen workers shall be ensured.

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

- ☐ The subcontractor shall arrange for the accommodation of workmen at nearby localities or by making a labour colony.
- ☐ Regular housekeeping of the labour colony shall be ensured.
- ☐ Proper sanitation and hygienic conditions to be maintained.
- ☐ Drinking water and electricity to be provided at the labour colony.
- ☐ Bathing/ washing bay
- ☐ Room ventilation and electrification.

8.4.8 PROVISION OF EMERGENCY VEHICLE

- Dedicated emergency vehicle shall be made available at workplace by each subcontractor to handle any emergency

8.4.9 PEST CONTROL

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labour colony and stores.

8.4.10 SCRAPYARD

- In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
- Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

8.4.11 ILLUMINATION

- The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.
- Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II). Some recommended values are given below:



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A. Construction Area		
1.	Outdoor areas like store yards, entrance and exit roads	20
2.	Platforms	50
3.	Entrances, corridors and stairs	100
4.	General illumination of work area	150
5.	Rough work like fabrication, assembly of major items	150
6.	Medium work like assembly of small machined parts	300
	rough measurements etc.	
7.	Fine work like precision assembly, precision	700
	measurements etc.	
8.	Sheet metal works	200
9.	Electrical and instrument labs	450
B. Office		
1.	Outdoor area like entrance and exit roads	20
2.	Entrance halls	150
3.	Corridors and lift cars	70
4.	Lift landing	150
5.	Stairs	100
6.	Office rooms, conference rooms, library reading tables	300
7.	Drawing table	450
8.	Manual telephone exchange	200

- Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.
- Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.
- Emergency lighting provision for night work shall be made to minimise danger in case of main supply failure.

If the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorized BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project details.
- Safety objectives and targets.
- Site HSE rules.
- Site HSE hazards and aspects.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labour colony (if applicable)



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- Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form (format no. HSEP:14-F03) to declare that he had understood the content and shall abide to follow and comply with safe work practices. They may only then be qualified to be issued with a personal I.D. card, for access to the work site.

9.2 HSE TOOLBOX TALK

- HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work. The agenda shall consist of the followings:
 - o Details of the job being intended for immediate execution.
 - o The relevant hazards and risks involved in executing the job and their control and mitigating measures.
 - o Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
 - o Recent non-compliances observed.
 - o Appreciation of good work done by any person.
 - o Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per format no. HSEP:14-F04
- Tool box talk to be conducted at least once a week for the specific work.

9.3 TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in-house/external faculty at least twice in a year. The training shall include following topics:

- Use of PPEs
- Use of fall arrester, retractable fall arrester, life line, safety nets etc.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.
- Dos & Don'ts during height work.

9.4 HSE TRAINING DURING PROJECT EXECUTION

- Other HSE training shall be arranged by BHEL/ subcontractor as per the need of the project execution and recommendation of HSE committee of site.
- The topics of the HSE training shall be as follows but not limited to:
 - o Hazards identification and risk analysis (HIRA)
 - o Work Permit System
 - o Incident investigation and reporting
 - o Fire fighting
 - o First aid
 - o Fire-warden training
 - o EMS and OHSMS
 - o T & Ps fitness and operation



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- o Electrical safety
- o Welding, NDE & Radiological safety
- o Storage, preservation & material handling.
- A matrix shall be maintained to keep an up-to-date record of attendance of training sessions carried out.

9.5 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC

9.5.1 Display of HSE posters and banners

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/English languages at work place

9.5.2 Display of HSE signage

- Appropriate HSE signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed

9.5.3 Competition on HSE and award

- Site will arrange different competition (slogan, poster, essay etc.) on HSE time to time (Safety day, BHEL day, World Environment Day etc.) and winners will be suitably awarded.

9.5.4 HSE awareness programme

- Subcontractor shall arrange HSE awareness programme periodically on different topics including medical awareness for all personnel working at site

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

- The subcontractor shall submit report of all incidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. (Refer HSE procedure for incident investigation, analysis and reporting for details)
- In addition, periodic reports on safety shall also be submitted by the subcontractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of incidents, fire and property damage to be submitted to BHEL safety officer as per prescribed formats.
- HSE incidents of site shall be reported to BHEL site Management as per Procedure for Incident Investigation and Reporting in format no. HSEP:14-F15. Corrective action shall be immediately implemented at the work place and compliance shall be verified by BHEL HSE officer and until then, work shall be put on hold by Construction Manager.

10.2 HSE EVENT REPORTING

- Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines
- Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.

10.3 DAILY HSE ACTIVITY REPORTING

Daily HSE activities shall be reported by subcontractor to BHEL as per Format No. HSEP:14-F31A



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11.0 OPERATIONAL CONTROL

All applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to subcontractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be refereed by subcontractor, if they so desire.

LIST OF OCPs

Safe handling of chemicals	Safety in use of cranes	Hydraulic test
Electrical safety	Storage and handling of gas cylinders	Spray insulation
Energy conservation	Manual arc welding	Trial run of rotary equipment
Safe welding and gas cutting operation	Safe use of helmets	Stress relieving
Fire safety	Good house keeping	Material preservation
Safety in use of hand tools	Working at height	Cable laying/tray work
First aid	Safe excavation	Transformer charging
Food safety at canteen	Safe filling of hydrogen in cylinder	Electrical maintenance
Illumination	Vehicle maintenance	Safe handling of battery system
Handling and erection of heavy metals	Safe radiography	Computer operation
Safe acid cleaning	Waste disposal	Storage in open yard
Safe alkali boil out	Working at night	For sanitary maintenance
Safe oil flushing	Blasting	Batching
Steam blowing	DG set	Piling rig operation
Safe working in confined area	Handling & storage of mineral wool	Gas distribution test
Safe operation of passenger lift, material hoists & cages	Drilling, reaming and grinding(machining)	Cleaning of hotwell / deaerator
Electro-resistance heating	Compressor operation	O&M of control of AC plant & system
Air compressor	Passivation	Safe Loading of Unit
Safe EDTA Cleaning	Safe Chemical cleaning of Pre boiler system	Safe Boiler Light up
Safe Rolling and Synchronization		

11.1 HSE ACTIVITIES

HSE activities shall be conducted at site based on the HSEMSM developed by Power Sector and issued to site by Regions.

While planning for any activity the following documents shall be referred for infrastructural requirements to establish control measures:

- 1) HSE Procedure for Register of OHS Hazards and Risks
- 2) HSE Procedure for Register of Environmental Aspects and Impacts
- 3) HSE Procedure for Register of Regulations



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- 4) Operational Control Procedures
- 5) HSE Procedure for Emergency Preparedness and Response Plan
- 6) Contract documents

11.2 WORK PERMIT SYSTEM

- ☐ The following activities shall come under Work Permit System
 - a. Height working above 2 metres
 - b. Hot working at height
 - c. Confined space
 - d. Radiography
 - e. Excavation more than 4 meter depth
 - f. Heavy lifting above 50 tonRefer Annexure 05 for Work permit formats.
- "HSE Procedure for Work Permit System" shall be followed while implementing permit system. Where customer is having separate Work Permit System the same shall be followed.
- ☐ Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- ☐ Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- ☐ Permit holder shall implement and maintain all control measures during the period of permit .He will close the permit after completion of the work. The closed permit shall be archived in HSE Department of site.

11.3 SAFETY DURING WORK EXECUTION

Respective OCPS are to be followed and adherence to the same would be contractually binding

11.3.1 WELDING SAFETY

All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

11.3.2 RIGGING

Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.

11.3.3 CYLINDERS STORAGE AND MOVEMENT

All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP

Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.

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When cylinders are transported by powered vehicle they shall be secured in a vertical position.

11.3.4 DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured:

- All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

11.3.5 T&Ps

All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL..Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.

11.3.6 CHEMICAL HANDLING

Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place.Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.

11.3.7 ELECTRICAL SAFETY

- Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
- Fulfilling safety requirements at all power tapping points.
- High/ Low pressure welders to be identified with separate colour clothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
- The subcontractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
- All portable electric tools used by the subcontractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. Details of earth resource and their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
- The subcontractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.



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- BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the subcontractor.
- All electrical appliances used in the work shall be in good working condition and shall be properly earthed.
- No maintenance work shall be carried out on live equipment.
- The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
- Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist" and the report is to be submitted to BHEL safety officer
- Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public
- The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

11.3.8 FIRE SAFETY

- Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
- Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labor colony etc. Such fire protection equipment shall be easy and kept open at all times.
- The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
- All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed.
- Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
- Emergency contacts nos must be displayed at prominent locations
- Tarpaulin being inflammable should not be used (instead, only non-infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

11.3.9 SCAFFOLDING

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from savor, from swaying, from the building or structure.

11.3.10 WORK AT HEIGHT:

- Guardrails and toe-board/barricades and sound platform conforming to IS:4912-1978 should be provided.



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- Wherever necessary, life-line (pp or metallic) and fall arrestor along with Polyamide rope or Retractable lifeline should be provided.
- Safety Net as per IS:11057:1984 should be used extensively for prevention/ arrest of men and materials falling from height. The safety nets shall be fire resistant, duly tested and shall be of ISI marked and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
- Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
- Use of Rebar steel for making Jhoola and monkey-ladder (Rods welded to vertical or inclined structural members), temporary platform etc. must be avoided.
- Monkey Ladder should be properly made and fitted with cages.
- Jhoola should be made with angles and flats and tested like any lifting tools before use.
- Lanyard must be anchored always and in case of double lanyard, each should be anchored separately.
- In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
- In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
- Empty drums must not be used.
- For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure along with separate fall arrestor. Rope ladder should be discouraged.

11.3.11 WORKING PLATFORM

Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

11.3.12 EXCAVATION

Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

11.3.13 LADDER SAFETY

Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least ¼" for each additional foot of length.

A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.

11.3.14 LIFTING SAFETY

- It will be the responsibility of the subcontractor to ensure safe lifting of the equipment, taking due precaution to avoid any incident and damage to other equipment and personnel.



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- All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the subcontractor by engaging only the Competent Persons as per law.
- Defective equipment or uncertified shall be removed from service.
- Any equipment shall not be loaded in excess of its recommended safe working load.

11.3.15 HOISTING APPLIANCE

- Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards.
- Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming incidentally displaced.
- When workers employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided.
- The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.

11.4 ENVIRONMENTAL CONTROL

Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

All subcontractors shall be responsible for the cleanliness of their own areas.

The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable & practicable precautions can be taken to protect other persons who may be affected.

It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.

The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

11.5 HOUSEKEEPING

- Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings has to be done by



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subcontractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the subcontractor

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at
- Different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Labour camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas

11.6 WASTE MANAGEMENT

Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

11.6.1 BINS AT WORK PLACE

- Sufficient rubbish bins shall be provided close to workplaces.
- Bins should be painted yellow and numbered.
- Sufficient nos. of drip trays shall be provided to collect oil and grease.
- Sufficient qty. of broomsticks with handle shall be provided.
- Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

11.6.2 STORAGE AND COLLECTION

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other work places.
- Do not burn construction rubbish near working site.

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11.6.3 SEGREGATION

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

11.6.4 DISPOSAL

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Make schedule for collection and disposal of waste.

11.6.5 WARNING AND SIGNS

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.
- Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

- Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.
- Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.
- For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.
- Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.
- Speed limits shall be clearly displayed. Speed ramps preceded by a warning signs or marker are necessary.
- The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce on-way system or parking restrictions.
- Safest route shall be provided between places where vehicles have to call or deliver.
- Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse



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- Safe areas shall be provided for loading and unloading.
- Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.
- Ensure road crossings are minimum and clearly signed.
- Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.
- Set sensible speed limits which are clearly sign posted.
- Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.
- Forklift trucks shall not pass over road hump unless of a type capable of doing so.
- Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.
- Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

- Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.
- Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.
- Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.
- Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.
- Provide high visibility clothing for people permitted in delivery area.

11.7.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

- o A high level of stability.
- o A safe means of access/egress.
- o Suitable and effective service and parking brakes.
- o Windscreens with wipers and external mirrors giving optimum all round visibility.
- o Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- o Provision of seat belts.
- o Guards on dangerous parts.
- o Driver protection - to prevent injury from overturning and from falling objects/materials.
- o Driver protection from adverse weather.
- o No vehicle shall be parked below HT/LT power lines.
- o Valid Pollution Under Control certification for all vehicles

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11.7.4 DAILY CHECK BY DRIVER

- There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.
 - o Brakes.
 - o Tires.
 - o Steering.
 - o Mirrors.
 - o Windscreen waters.
 - o Wipers.
 - o Warning signals.
 - o Specific safety system i.e. control interlocks
- Management should ensure that drivers carry out these checks.

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

- All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.
 - Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.
 - All overhangs shall be made clearly visible and restricted to acceptable limits
 - Load shall be checked before moving off and after traveling a suitable distance.
 - On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.
 - Warning signs shall be displayed during transportation of material.
- All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

11.7.6 MAINTENANCE

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

- Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by Regional HQ
- Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors
- All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape.



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- Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection
- Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.
- First aid center shall be developed at site with trained medical personnel and ambulance
- Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.
- Tie up with fire brigade shall be done in case customer is not having fire station.
- Tie up with hospital shall be done in case customer is not having hospital.
- Disaster Management group shall be formed at site
- Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
- Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc. as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:14-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.

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12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:14-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:14-F08

12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:14-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
 - o Fall arrestor
 - o Lifelines
 - o Safety nets
 - o Fencing and barricading
 - o Warning signage
 - o Covering of opening
 - o Proper scaffolding with access and egress.
 - o Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.



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- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

12.8 INSPECTION OF ELEVATOR

- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

12.9 INSPECTION OF EXCAVATION

Excavation activities shall be inspected as per Format HSEP:14-F13A

13.0 HSE PERFORMANCE

- Contractor shall be assessed on monthly basis for HSE Compliance by BHEL Safety In-charge at site. The HSE compliance shall be based on Online HSE Evaluation System of BHEL as per Format No. HSEP:14-F33.
- BHEL shall reserve the right to use this assessment for evaluating bidder's capacity for future tenders
- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen by the subcontractor.
To decide HSE reward, performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

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14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non-compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.



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- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slings properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

• Legend:-

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.



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17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist (**Annexure 02**) shall be used for carrying out audit/inspection and report shall be submitted to BHEL site management
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

18.0 MONTHLY HSE REVIEW MEETING

- ☐ Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting, its root cause and Corrective action and Preventive action. The agenda is given below:
 - o Implementation of earlier MOM
 - o HSE performance
 - o HSE inspection
 - o HSE audit and CAPA
 - o HSE training
 - o Health check-up camp
 - o HSE planning for the erection and commissioning and installation activities in the coming month
 - o HSE reward and promotional activities
- ☐ The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- ☐ MOM on the discussion will be circulated to the concerned for implementation.

19.0 FORMATS USED (Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:14-F01	00
02	Health Check Up	HSEP:14-F02	00
03	HSE Induction Training	HSEP:14-F03	00
04	Tool Box Talk	HSEP:14-F04	00
05	Monthly Site HSE Report	As specified by BHEL	00
06	Inspection of PPE	HSEP:14-F06	00



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07	Inspection of T&Ps	HSEP:14-F07	00
08	Status of T&Ps	HSEP:14-F08	00
09	Inspection of Cranes and Winches	HSEP:14-F09	00
10	Inspection on Height Working	HSEP:14-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:14-F11	00
12	Inspection on Electrical Installation	HSEP:14-F12	00
13	Inspection on Elevator	HSEP:14-F13	00
14	HSE Penalty	HSEP:14-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:14-F15	00



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20.0 ANNEXURES

ANNEXURE 01

As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,

- (1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.



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(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoupment of the equipment when necessary.



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ANNEXURE 02

HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT

PROJECT: _____

SUBCONTRACTOR: _____

DATE : _____

OWNER : _____

INSPECTION BY: _____

Note : write 'NA' wherever the items is not applicable

Item	Y e s	N o	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNEL PROTECTIVE EQUIPMENTS				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
EXCAVATIONS / OPENINGS				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
WELDING, CUTTING				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
SCAFFOLDING				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
LADDER				
Extension side rails 1 m above				
Top of landing				
Properly secured				



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Angle + 70° from horizontal				
Other				
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
MACHINERY, TOOLS & EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
TEMPORARY FACILITIES				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
FIRE PREVENTION				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
ELECTRICAL				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
HANDLING & STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				



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Other				
WORKING AT HEIGHT				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
ENVIRONMENT				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
HEALTH CHECKS				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				



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ANNEXURE 03

REFERENCES

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002)	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification



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(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 2003)	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing



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**ANNEXURE 04 : SAFETY FORMATS
&
ANNEXURE 05 : WORK PERMIT FORMATS**

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:14-F01

REV NO.: 00

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Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Number of employees on the site: - _____

Sl.No.	Item	No. Available	Remarks
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of Suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:14-F01

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Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti-septic solution available		

Signature of Subcontractor's Site I/C:

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:14-F02

REV NO.: 00

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Name of Site :	
Name of Sub-Contractor :	
Name of Employee :	

NAME:

History Of Past Illness	H/O Epilepsy
	H/O Drug Allergy
	H/O Diabetics/ Hypertension
	H/O Unconsciousness
Personal History	
EXAMINATION	
OBSERVATION	
<u>General Physical Examination</u>	
Height	:
Weight	:
BMI	:
Built And nourishment	:
Pallor	:
Temperature	:
Chest Expansion	: Inspiration Expansion
Lymph Node Enlargement	:
<u>Ear, Nose, Throat</u>	:
Ear	:
Nose	:
Throat	:

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:14-F02

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EXAMINATION	OBSERVATION
<u>Cardiovascular System Examination :</u>	
Inspection :	
Palpation :	Pulse BP
Auscultation (Heart Sounds) :	
<u>Respiratory System :</u>	
Inspection :	Respiratory Rate
Palpation:	
Percussion :	
Auscultation (Breath Sounds) :	
<u>Examination of Abdomen :</u>	
Inspection :	
Palpation :	
Auscultation (Bowel Sounds) :	
Any Other :	
Clinical Impression	

Signature of the examining doctor

**POWER SECTOR****HSE INDUCTION TRAINING**

FORMAT NO: HSEP:14-F03

REV NO.: 00

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Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Sl No.	Name	Designation	Organisation	Signature

Signature of Training co-ordinator :

	POWER SECTOR	FORMAT NO: HSEP:14-F04 REV NO.: 00 PAGE NO. 01 OF 01
	TOOL-BOX TALK	

Name of Site :	
Sub-Contractors Name :	
Date :	

Topic	Name of person delivered Tool Box Talk	No. of Participants attended	Remarks

Signature of Site I/C of Subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:14-F06 REV NO.: 00 PAGE NO. 01 OF 01
	PERSONAL PROTECTIVE EQUIPMENTS	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Item	Issued this Month	Nos. Issued up to the Month	Percentage of usage at site
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

Signature of Site I/C of Subcontractor :

**POWER SECTOR****INSPECTION OF T&Ps**

FORMAT NO: HSEP:14-F07

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Name of Site :	
Name of Sub-Contractor :	
Date of Inspection :	

Sl.No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs / overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Site Safety Officer (BHEL)

Signature-Subcontractor/ Subcontractor's
Safety Officer

	POWER SECTOR	FORMAT NO: HSEP:14-F08 REV NO.: 00 PAGE NO. 01 OF 01
	STATUS OF T&Ps	

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	Nos. Deployed	Identification No.	Nos. Tested by competent person	Validity of Test Certificate
Winches				
Chain Blocks				
Wire Rope Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor:

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:14-F09

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Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Crane Reg. No (Make/Model) _____

Name of Driver/Operator _____

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers fully extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		



POWER SECTOR

INSPECTION OF CRANES AND WINCHES

FORMAT NO: HSEP:14-F09

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PAGE NO. 2 OF 03

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

WINCH

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:14-F09

REV NO.: 00

PAGE NO. 3 OF 03

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	Total Number of NO:				
	Total Number of NA:				
	% Compliance :				

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:14-F10 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF HEIGHT WORKING	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
	ACCESS/EGRESS		
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36" above top landing?		
7	Are built up ladders constructed of sound materials?		

**POWER SECTOR****INSPECTION OF HEIGHT WORKING**

FORMAT NO: HSEP:14-F10

REV NO.: 00

PAGE NO. 02 OF 02

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12" on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	Housekeeping		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	PPE And Safety Devices		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**

FORMAT NO: HSEP:14-F11
REV NO.: 00
PAGE NO. 1 OF 02

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Welding				
Sl.no.	Description	Y e s	N o	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**

FORMAT NO: HSEP:14-F11
REV NO.: 00
PAGE NO. 2 OF 02

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	% Compliance			

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:14-F12 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF ELECTRICAL INSTALLATION	

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection:	

Sr. No.	Contents	Yes/No	Remarks
A	Cable		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
B	DBs/SDBs		
1.	Is earth conductor continued up to DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
C	ELCB		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:14-F12

REV NO.: 00

PAGE NO. 02 OF 02

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
D	Grounding		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
E	Electrically operated Machines or Accessories.		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF ELEVATOR**

FORMAT NO: HSEP:14-F13

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Sr. No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Subcontractor/ Subcontractor's
Safety Officer

Signature-Site Safety Officer (BHEL)

	POWER SECTOR	FORMAT NO: HSEP:14-F13E REV NO.: 00 PAGE NO. 01 OF 01
	Inspection of Excavation	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Sl.no.	Description	Yes	No	Remarks
1	Precautions taken for Underground Electrical Cable			
2	Precautions taken for Under / Above ground sewer/ Drinking Water Line			
3	Precautions taken for Underground Telecommunication Line			
4	Precautions taken for Underground Product/Utility Line			
5	Precautions taken for Underground Fire Water Line			
6	Shoring / Shuttering / Sheet piling done to prevent collapse of excavation walls. Strength of Excavation wall ensured at all times			
7	Slope Cutting / Angle Maintained			
8	Hard Barricading & Edge Protection provided			
9	Separate Safe Access for Man and Vehicle			
10	Lighting arrangement			
11	Banksman Provided			
12	Required basic PPEs provided			
13	Excavated soil / Construction Material / equipment kept away from the edge.			
14	First aid in attendance.			
15	Other:			
	Total No of YES			

Signature-Subcontractor/ Subcontractor's Safety Officer

Signature-Site Safety Officer (BHEL)

**POWER SECTOR****HSE PENALTY**

FORMAT NO: HSEP:14-F14

REV NO.: 00

PAGE NO. 1 OF 02

Sub: MEMO for Penalty for non-compliances in Safety

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

Safety Area

SN	Violation of Safety Norms	Fine (in Rs)
01.	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03.	Not wearing safety shoe	200/-*
04.	Not keeping gas cylinders vertically	200/-
05.	Not using flash back arrestors	100/-
06.	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slings properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18.	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

Legend: -

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

1 Copy to Site Construction Manager (BHEL)

	POWER SECTOR- HQ	FORMAT NO: HSEP:14-F15 REV NO.: 00 PAGE NO. 01 OF 01
	Incident Report (To be submitted within 24 hours of time of incident)	

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA	
2	SCOPE OF WORK		4	NAME OF CONTRACTOR	
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C	
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED	
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)				
9	NO. OF MANHOURS LOST BY OTHERS				
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED				
NAME			NAME OF MATERIAL / EQUIPMENT / PROPERTY		
PERIOD OF EMPLOYMENT					
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST
MARITAL STATUS		SINGLE / MARRIED			
OCCUPATION		NATURE OF DAMAGE			
PART OF BODY INJURED					
NATURE OF INJURY					
AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE					
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) CAUSING ACCIDENT INJURY / DAMAGE				
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED)				
ANALYSIS					
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT				
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?				
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?				
	DATE :		SIGNATURE OF SITE HSE COORDINATOR		
17	COMMENTS OF HEAD / SOX				
	DATE:		SIGNATURE OF HEAD/SOX		



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30

REV NO.: 00

PAGE NO. 01 OF 3

Note: This is a template and can be modified in consultation with BHEL

Name of the Site		Name of the Subcontractor	
Scope of Work		Date	
PART- A: PLAN OF HSE ACTIVITIES FOR THE MONTH OF.....		PART-B: REVIEW ON	
SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
1	Availability of First Aid Box at Required Places and Inspection thereof as per Format: Fo1	Areas 1.	
2	Health check-up as per Format: Fo2	Health check-up for Nos 1. New inductees 2. Drivers & Operators 3. Workers in following high risk areas: a. ...	
3	Induction training of newly joined workers as per Format: Fo3	Minimum No. of workers:	
4	Toolbox talks (TBT) conducted before start of work as per Format: Fo4	Locations of TBTs & No. of workers 1. ...	
5	PPE usage and issue as per Format: Fo6		
6	Inspection of T&Ps as per Format: Fo7	List of T&Ps to be inspected 1.	
7	Identification & Inspection Status of T&Ps as per Format: Fo8		
8	Inspection of Cranes & Winches as per Format: Fo9	List of Cranes & Winches & Nos. 1. ...	
9	Inspection of Height Working as per Format: F10	Areas: 1. ...	
10	Inspection of Welding & Gas Cutting operations as per Format: F11	Areas: 1. ...	
11	Inspection of Electrical Installations as per Format: F12	Locations: 1. ...	
12	Inspection of Elevators (as applicable) as per Format: F13	Locations: 1. ...	
13	Inspection of Excavation as per Format: F13E	Locations: 1. ...	



POWER SECTOR

Format for Monthly HSE Planning & Review

FORMAT NO: HSEP:14-F30

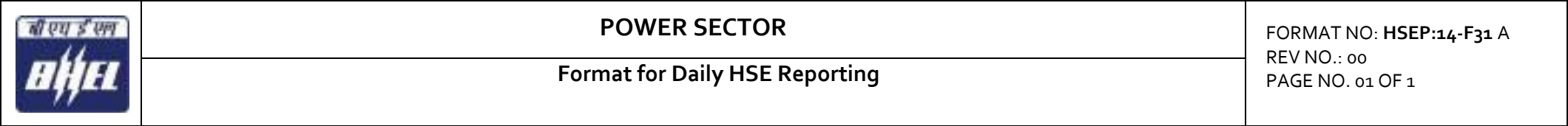
REV NO.: 00

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SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
14	Job Safety Analysis as per Format F32B	Activities: 1. ...	
15	Regular Job Specific Training (Re-training) for workers involved in hazardous activities	Topics/ Hazards & No. of workers 1. ...	
16	Mass housekeeping (HK) drive in work areas	Areas 1. ...	
17	Vertigo Test of Height workers	Minimum No. of workers:	
18	Deployment of qualified HSE Officers as per contract	Location(s) & Nos. 1. ...	
19	Deployment of qualified HSE Stewards as per contract	Location(s) & Nos. 1. ...	
20	Deployment of Safety tools & Equipment (Safety Nets, Lifelines, Fall arrestors, Man-cages, flashback arrestors, scaffolding etc.)	Tool/ Equipment & Location 1. ...	
21	Safety Walks by site in charge of agency (4 -Weekly once)	Dates:	
22	Safety walks by departmental head (8-Weekly twice)	Dates:	
23	Availability/ deployment of Safety posters/ placards/ signage at strategic locations	Locations: Nos. 1. ...	
24	Provision of clean drinking water sources for workers	Locations: Nos. 1. ...	
25	Provision of toilets for workers (separate for male & female workers)	Locations: Nos. 1. ...	
26	Rest sheds for workers during lunchtime, rain, dust storm etc.	Locations: Nos. 1. ...	
27	Availability of following in Labor colony	1. Clean drinking water 2. Toilets 3. Cleanliness & Hygiene 4. Grass cutting, 5. Fogging 6. Electrical Inspection ...	

	POWER SECTOR		FORMAT NO: HSEP:14-F30 REV NO.: 00 PAGE NO. 03 OF 3
	Format for Monthly HSE Planning & Review		
SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
28	Availability of dust/ waste bins at various locations	Locations: 1. ...	
29	Availability of Ambulance (individual/ joint) in each shift	Ambulance No.	
30	Availability of emergency vehicle in each shift	Emergency vehicle	
31	Deployment/ Availability of tested Fire Extinguishers	Locations & Nos. 1. ...	
32	Tree plantation	Locations & Nos. 1. ...	
33	Waste disposal & Scrap Bins	Locations 1. ...	
34	Illumination checks	Locations 1. ...	
35	Safety award function: 1. Display of good practices Award presentation	Minimum 1 per month	
36	Submission of Daily Reports as per Format No.F31A	Daily Reports (Night & Day Shifts)	

PLAN		REVIEW	
<u>Agency</u> Name:	<u>BHEL</u> Name:	<u>Agency</u> Name:	<u>BHEL</u> Name:
Sign:	Sign:	Sign:	Sign:
Date:	Date:	Date:	Date:



	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	POWER SECTOR	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

PAGE NO. 01 OF 1

Note: Following format to be submitted (preferably) in excel/ soft copy by subcontractor daily at the end of each shift. Any photographs/ records to be attached

		Site
Night	Day	SHIFT
		Submitted By
		Work Area(s)
		Staff
		Man-Power
		Safety Officers
		Safety Stewards
		Tool Box (Topics and No. of Participants)
		Induction Training (No. of Participants)
		Vertigo Test (Numbers Tested)
		On-the-Job Training (Topic & participants)
		Work Permits
		Job Safety Analyses conducted
		Height Work Inspection
		Other Hazardous Activities Inspection
NA		T&P Inspection (Names & Nos. Inspected)
		Safety Walk (Designation, Areas)
NA		HSE Meeting
NA		Safety Reward (Details)
NA		Housekeeping/ Dust Suppression/ Tree Plantation Activities (Locations/ Details)
		Lost time Accident
		Restricted Work Case
		Medical Treatment Case
		First Aid Case
		Near miss
		Property Damage/ Fire
		Non-Compliances Submitted by BHEL
		Complied by Agency
		Any other Remarks/Inputs



POWER SECTOR

Job Safety Analysis Format

FORMAT NO: HSEP:14-F32B

REV NO.: 00

PAGE NO. 01 OF 1

Name of the Site

Name of the Subcontractor

Activity, Area

HAZARDS

PRECAUTIONS

(Name)

(Sign)

(Date)

Submitted By
(Agency HSE)

Reviewed By
(BHEL
Execution)

Approved By
(BHEL HSE)

**POWER SECTOR- HQ**

FORMAT NO: HSEP:14-F33

REV NO.: 00

PAGE NO. 01 OF 3

Checklist for Evaluation of HSE Performance

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
1a	Induction training for new workers conducted through audio-visual medium & documented ?	M	1	Induction Training Records
1b	Tool box talk conducted regularly as per plan, and documented?	M	1	Toolbox Talk Records
1c	Contractor in charge and safety in charge attended safety meetings?	M	2	Minutes of Meeting
1d	Whether observations in safety meetings are complied before next meeting?	M	2	-do-
1e	Preparation and submission of Monthly HSE report within stipulated time	M	1	Report submission date
1f	Preparation and submission of Incident/near-miss report and RCA Report (as applicable) within stipulated time	M	1	Incident/ Near Miss Records
1g	Carrying out Inspections and submission of Inspection reports within stipulated time	M	1	Inspection Records
1h	Regular Job Specific Training ensured for High Risk Workers (through audio-visual medium) as per plan	M	1	Training & Attendance Records
2a	Whether the contractor is registered under BOCW	M	2	BOCW Registration Certificate
2b	Availability of Qualified safety officer (1 for every 500 labour)	M	2	Safety Officer qualification & experience records
2c	Availability of Qualified safety supervisor (1 for every 100 labour)	M	2	Safety Officer qualification & experience records
2d	All the workers are provided and using safety helmets and safety shoes/gum boots	M	2	PPE Issue Records, Inspection/ non-conformity records
2e	Housekeeping done on regular basis and scrap removal at site	M	1	Housekeeping records, Inspection/ non-conformity records
2f	Usage of Goggles/Face shields and Hand gloves for gas cutter and grinders		1	PPE Issue Records, Inspection/ non-conformity records
2g	Wall openings & floor openings are guarded?		1	Inspection/ non-conformity records
2h	Adequate illumination provided in all working area?		1	Inspection/ non-conformity records
2i	Safety posters, sign boards and emergency contact numbers in all prominent location are displayed?		1	Inspection/ non-conformity records
2j	Availability of automatic reverse horns, Main horn, hook latches for Vehicles, mobile cranes, Hydras		1	Inspection/ non-conformity records
2k	Ban of carrying mobile phones to work place is implemented for workers		1	Inspection/ non-conformity records
2l	Availability of Tags & Inspection Certificates for Cranes of all capacities		1	Master T&P List with internal & external test details
2l.2	Availability of Tags & Inspection Certificates for Winches of all capacities		1	Master T&P List with internal & external test details
2l.3	Availability of Tags & Inspection Certificates, color coding for Chain pulley blocks		1	Master T&P List with internal & external test details
2l.4	Availability of Tags & Inspection Certificates for Vehicles - Trailers, Dozers, Dumpers, Excavators. Mixers etc.		1	Master T&P List with internal & external test details
2l.5	Availability of Tags & Inspection Certificates for Welding machines, grinders, Drilling machines, etc.		1	Master T&P List with internal & external test details
2l.6	Availability of Tags & Inspection Certificates, colour coding for Wire rope slings etc.		1	Master T&P List with internal & external test details
2l.7	Availability of Tags & Inspection Certificates for Batching plants		1	Master T&P List with internal & external test details



POWER SECTOR- HQ

FORMAT NO: HSEP:14-F33

REV NO.: 00

PAGE NO. 02 OF 3

Checklist for Evaluation of HSE Performance

SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
2m.1	Use of Lifting Permit as per requirement		1	Permit Records
2m.2	Use of Height Permit as per requirement		1	Permit Records
2m.3	Use of Hot Work Permit as per requirement		1	Permit Records
2m.4	Use of Excavation permit as per requirement		1	Permit Records
2m.5	Use of Confined space work permit as per requirement		1	Permit Records
2m.6	Use of Grating removal and safety net removal permit as per requirement		1	Permit Records
2m.7	Use of Lockout-Tag out permit as per requirement		1	Permit Records
2m.8	Use of Radiography permit as per requirement		1	Permit Records
2m.9	Use of Night/ Holiday Work Permit as per requirement		1	Permit Records
2m.10	Use of Any other Applicable Permit as per requirement		1	Permit Records
3a	Material safety data sheet(MSDS) available for all chemicals and displayed in usage and storage area?		1	Inspection/ non-conformity records
3b	Spillages of oil/concrete and other chemical is controlled and cleaned by proper method in case of spill?		1	Inspection/ non-conformity records
3c	Availability of adequate number of urinals in workplace and in elevations and maintained	M	1	
3d	Availability of rest rooms for workers at site	M	1	
3e	Availability of Drinking water facility at work spot		1	
3f	Hygienic Labour colony is provided for workers.		1	
4a	Is heavy/complex critical lifting permit obtained for heavy, complex materials before handling/erection activity?		1	Work Permit records
4b	Whether area below lifting activities barricaded		1	Inspection/ non-conformity records
4c	Availability of experienced rigging foreman		1	Experience details of rigging foreman
4d	Is agency is following proper storage and handling procedure as per manufacturer standard for all hazardous material?		1	Procedure for storage & handling
4e	Are oxygen and acetylene cylinders are transported to work place from storage area in trolleys		1	
5a	Whether all deep excavation has been protected by barrier		1	Inspection/ non-conformity records
5b	Sloping/benching & shoring provided for excavation as per requirement?		1	-do-
5c	Proper access and egress provided for excavations?		1	-do-
5d	Blasting is done in controlled manner?		2	-do-
6a	Whether Electrical booth is equipped with Co ₂ fire extinguishers and fire buckets filled with sand?		2	Inspection/ non-conformity records
6b	Availability of Illumination lamp in electric booth?		1	-do-
6c	whether Caution Boards have been displayed?		1	-do-
6d	Usage of Metal Plug top for all hand power tools ?		1	-do-
6e	Usage of Insulated welding cables.		1	-do-
6f	Electrical Booth/Distribution Board to be covered by proper Canopy.		1	-do-
6g	Availability of functional & individual 30mA ELCB / RCCB and MCB for protection and conducting periodical check-up?		1	-do-
6h	Double earthing for panel boards and all machinery & proper earth pit with regular inspection available?		1	-do-
6i	Whether Electrician is qualified and experienced		1	Qualification & Experience records of electrician
6j	Availability and usage of Rubber hand gloves by electrician?		1	Inspection/ non-conformity records

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SL	Parameter for Measurement	M/ O	Wt	Supporting Documents
7a	Whether Scaffolding pipes made with steel or aluminum, are being used and checked periodically by experienced/ certified scaffolder?		2	Inspection/ non-conformity records
7b	8mm Stainless Steel wire rope with plastic cladding is provided for life line (Vertical / Horizontal) during height work?		2	-do-
7c	Availability of emergency lighting in case of power failure		1	-do-
7d	Whether all the openings are covered with Safety Nets made of fire proof Nylon?		1	-do-
7e	Whether MS pipe rails around staircases & platforms in usage are provided with top, middle rails and toe guard ?		1	-do-
7f	Whether Ladder with vertical life line /Fall arrestor is available to climb?		1	-do-
7g	Whether all workers deployed for working at height have been issued height pass after undergoing vertigo test?		1	Height Pass records
7h	Whether all workers deployed for height work / climbing ladder are provided and using Double lanyard safety belt?		1	PPE Issue records, inspection/ non-conformity reports
7i	Is all hand tools/Small material used by height workers is tied firmly to prevent fall?		1	-do-
8a	Flash back arrestors for all gas cutting sets is available on Torch side and cylinder side		1	Inspection/ non-conformity records
8b	Oxygen/Acetylene/LPG cylinders not in use have caps in place and stored separately?		1	-do-
8c	Availability of Face screen, Hand gloves, and Apron, for welders		1	-do-
8d	Protection from falling hot molten metal during metal cutting / welding at height by providing GI sheet below the cutting area especially in fire prone areas		1	-do-
9a	Pre-employment medical check-up done for all workers and submitted?		1	Medical check records
9b	Availability of first aid center, with MBBS doctor(Own or Sharing basis)	M	2	Attendance records
9c	Availability of Ambulance facility 24 hours (Own or sharing basis)	M	2	-do-
9d	Is First aid trained personnel's are available and their names are displayed at site?	M	1	-do-
9e	Availability of Emergency vehicle at site		1	
9f	Periodical medical check-up is conducted for all the workers and submitted?		1	Medical check records
9g	Availability of sufficient number of first aid box as per standard list and maintaining record		1	Inspection records
10a	Availability of Fire extinguishers, buckets at all vulnerable points		2	Fire extinguisher records
10b	Periodic fire mock drill conducted?		1	Fire, Mock drill records
10c	Are all flammable materials are stored separately?		1	
10d	Periodic grass cutting is done in material storage area?		1	
10e	Availability of 24V DC lighting in confined space work area		1	
10f	Availability of exhaust fan in confined space work area		1	

Note:

- **M: Mandatory; O: Optional.** Points other than mandatory can be excluded with appropriate justification (scope etc.) by BHEL
- Additionally: 30 Marks for each Fatal Accident and 10 mark for each major accident shall be deducted.



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

BURNING/WELDING /HOT WORK PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____

Name of Work Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ **Sign:** _____ **Date:** _____ **Time:** _____**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

LIFTING ACTIVITY PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____ Name of Work

Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorized/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked and in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ **Sign:** _____ **Date:** _____ **Time:** _____**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site**Second Copy – BHEL SAFETY****Third Copy : Contractor**



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

WORKING AT HEIGHT PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____ Name of Work

Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes (non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ **Sign:** _____ **Date:** _____ **Time:** _____**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site**Second Copy – BHEL SAFETY****Third Copy : Contractor**



Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#1.01	Cumulative number of days in the month, the nominated Quality Officer or his authorised nominee was not available	QUALITY	1.5		Quality Officer or his authorised nominee should be available for all the days of working at site	Daily Log Book entry/Incident Registers/letter references
#1.02	Number of instances of non- compliance wrt FQP, Standard Drawings, Specifications, E&C Manuals etc.	QUALITY	1.5		No deviation from FQP, Standard Drawings, Specifications, E&C Manuals etc. is allowed without BHEL Engineer's approval.	Daily Log Book entry/Incident Registers/letter references
#1.03	Percentage submission of test certificates for batches of welding electrodes, cement, sand, aggregate, consumable, Paints etc. as applicable for this month OR In case of MM & MH package, monthly checks for Storage/Preservation of material.	QUALITY	1		Submission of 100% Test certificates for materials as per FQP is mandatory. MM & MH package: Storage/Preservation as per manual/procedure.	Daily Log Book entry/Incident Registers/letter references
#1.04	Number of incidences of improper storage & preservation (not in accordance to the guidelines of BHEL MUs or approved FQP) of materials, consumables (viz. gases, welding electrodes & fluxes, fuel etc.) & bought-out items (paints, fasteners etc.) under the custody of the contractor	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#1.05	Rework/ Rejection instances in a month necessitated due to deviation from Standard Drawings /Specifications /Manuals /E&C procedures /FQPs or due to Poor Workmanship by contractor	QUALITY	2		Reworks/ Rejection should be as minimum as possible. Total number of reworks/ rejections due to reasons attributable to contractor.	Daily Log Book entry/Incident Registers/letter references
#1.06	Delay in preparation & submission of signed protocols / log sheets / site register / NDT test reports as per approved FQP/ Qualified Welder List along with photocopies of Welder ID cards / Welder Performance Evaluation records etc. in the month OR in case of MM / MH package reconciliation statement / verification report.	QUALITY	1		Within 2 days of measurements taken or within first 3 working days of next month, as advised by BHEL Engineer	Daily Log Book entry/Incident Registers/letter references
#1.07	Number of instances for Major equipment/product failure due to negligence/improper work/poor workmanship by contractor	QUALITY	1		No such event should happen	Daily Log Book entry/Incident Registers/letter references
#1.08	Total number of complaints received in the month on the quality of finish / aesthetics	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#2.01	Cumulative number of days of delay in submission of Plan FOR THE MONTH supported by deployment plan of Major T&Ps and Manpower (as per Form F-14) and relevant construction/layout drawings - like A4 plan / elevation views of plan status for structures / pressure parts/Civil Works, Piping isometrics for piping, Layout / PID / System reference sketch, Unloading / storage plans etc.as applicable.	PERFORMANCE	5		Number of days delayed from second working day of the month	Daily Log Book entry/Incident Registers/letter references
#2.02	Percentage of timely submission of Daily Reports for Progress of work, Resources, Consumables etc.	PERFORMANCE	1.5		Percentage of timely submission of daily reports/ Scheduled date is successive next day for each day	Daily Log Book entry/Incident Registers/letter references
#2.03	Number of days delayed for submission of FQP log sheets / protocols / Monthly Progress Reports for the work executed during the month under measurement	PERFORMANCE	1.5		Number of days delayed/Scheduled date is first 2 working days of next month	Daily Log Book entry/Incident Registers/letter references
#2.04	Shortfall attributable to contractor w.r.t. Plan as per Form-14 for the subject month	PERFORMANCE	35		Percentage of shortfall to be calculated w.r.t. Total planned target for the month as per part-A of F-14. If more than one work has been planned in a month then Weightages of works shall be assigned at the time of plan to arrive at plan vs achievement calculation.	Progress review formats
#2.05	Number of days delayed in submission of Running bills with complete supporting documents (including updated reconciliation statement of BHEL issued material) for the month	PERFORMANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#2.06	Number of times the Top Management of contractor did not respond to critical issues of site, for the month	PERFORMANCE	1		Total number of instances	Daily Log Book entry/Incident Registers/letter references
#2.07	Cumulative number of days in the month the works were stopped / refused on interpretation of contract clauses/scope due to tendency of taking undue advantage by interpreting contract clauses in their favour	PERFORMANCE	2		Cumulative number of days lost	Daily Log Book entry/Incident Registers/letter references
#2.08	Number of times rework was refused by contractor	PERFORMANCE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#2.09	Cumulative number of days in the month recording / logging was not done in daily log / history register / hindrance register / soft form in a PC maintained at BHEL Site Office	PERFORMANCE	1		Cumulative number of days recording or logging was not done / all days of the month	Daily Log Book entry/Incident Registers/letter references
#3.01	Number of days of non-availability of required Manpower including supporting staff as per plan submitted in F-14 for the month.	RESOURCES	7		Cumulative number of days Sufficient Manpower was not available as per Plan in F-14	Daily Log Book entry/Incident Registers/letter references
#3.02	Number of days of non-availability of required T&P as per plan submitted in F-14 for the month.	RESOURCES	7		Cumulative number of days Sufficient T&P was not available as per Plan in F-14	Daily Log Book entry/Incident Registers/letter references
#3.03	Cumulative number of major instances in the month hampering / affecting progress of work due to breakdown or non-availability of major T&P and MME for the work, under the scope of Contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#3.04	Cumulative number of major instances in the month hampering / affecting progress of work due to non-availability of Consumables/ use of improper consumables under the scope of contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#4.01	Number of non-compliances during the month for Statutory requirements like validity of Labour Licence, Insurance Policy, Labour Insurance, PF, BOCW Compliance etc. and any other applicable laws/ Regulation, Electrical Licence, T&P fitness certificate, Contractors' All Risk Policy etc. as applicable	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#4.02	Cumulative number of days in a month poor illumination is reported at storage area, erection area, pre-assembly area and other designated areas by BHEL site.	SITE INFRASTRUCTURE & SERVICE	0.5		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.03	Cumulative number of days of non-availability of well-maintained toilets facilities for workers (separate for men and women) and non-availability of potable drinking water stations for workers in specified areas.	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#4.04	Total number of instances in the month, Housekeeping NOT attended to in spite of instructions by BHEL -i.e. removal / disposal of surplus earth / debris / scrap / unused / surplus cable drums / other electrical items / surplus steel items / packing materials, thrown out scrap like weld butts, cotton waste etc. from the working area to identified locations	SITE INFRASTRUCTURE & SERVICE	2		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.05	Total number of instances in a month, Site Office with reasonably good facilities including enough nos. of computers and printers etc. for use by office and supporting staff was not made available/maintained.	SITE INFRASTRUCTURE & SERVICE	0.5		No discrepancy during regular or surprise visits	Photograph and report of the Engineer
#5.01	Number of days delayed in making labour payments for the last month	SITE FINANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#5.02	Number of complaints from labour/ sub supplier/ sub-contractor for non-receipt of payments from contractor	SITE FINANCE	1.5		Total number of complaints or reporting	Daily Log Book entry/Incident Registers/letter references
#5.03	Number of times the site operations were hampered for want of funds at the disposal of site-in-charge.	SITE FINANCE	1.5		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.01	Cumulative number of days in a month the nominated Safety Officer was not available	HSE & SA	1		Safety Officer should be available for all the days	Daily Log Book entry/Incident Registers/letter references
#6.02	Shortfall in number of weekly safety meetings in the month conducted or attended by the Safety Officer	HSE & SA	0.5		Safety meetings to be held every week	Copy of Minutes of meeting
#6.03	Level of compliance w.r.t decisions taken in previous Safety meetings	HSE & SA	0.5		Number of consolidated issues discussed in Safety meetings	Copy of Minutes of meeting, Non-compliance intimation documents from BHEL site
#6.04	Delay in submission of monthly report on safety (including electrical safety for equipment & personnel etc.) in the prescribed form	HSE & SA	1		Number of days delayed/Scheduled date is third working day of next month	Daily Log Book entry/Incident Registers/letter references
#6.05	Number of days taken for lodging FIRs from date of occurrence/notice of incident of theft / accident etc.	HSE & SA	0.5		Number of days delayed/Scheduled date is within 24 Hrs of occurrence/notice of incidence	Copy of FIR lodged by Contractor

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
#6.06	Number of times written(email, letters etc.) warning issued for non-availability/ use of improper Fall protection and rescue arrangement as lifeline, fall arrestors, safety net, hand-railings, covered floors, man-basket, rescue basket & kit etc. by the contractor	HSE & SA	2		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.07	Number of times punitive fines imposed for unsafe practices as per contract like non-availability/use of PPEs as safety shoes, helmets, goggles, gloves, lifeline, safety belts etc.	HSE & SA	1		Total number of non-compliances	Non-compliance intimation documents from BHEL site
#6.08	Percentage compliance to Emergency preparedness and response plan: Portable Fire-extinguishers, Buckets, Fire-wardens, display of emergency numbers, mock-drills, Hazard Identification and Risk Assessment(HIRA) etc.	HSE & SA	1		Compliance should be 100% as per HSE Plan or as finalized in Safety Meetings	Non-compliance intimation documents from BHEL site
#6.09	Number of times the agency has defaulted on display of safety posters / safety slogans / safety barriers/emergency numbers etc. in identified areas	HSE & SA	0.5		Total number of instances	Non-compliance intimation documents from BHEL site
#6.10	Non compliances observed during HSE and Safety Audit	HSE & SA	0.5		Total number of non-compliances	Non-compliance intimation documents from BHEL site, Audit Reports
#6.11	Cumulative number of days in the month, non-availability of First Aid Kit, First Aider & Emergency Vehicles/Ambulance.	HSE & SA	0.5		Cumulative number of days	Non-compliance intimation documents from BHEL site
#6.12	Number of days taken for submission of Root Cause analysis (RCA) for the accident from the cut-off date intimated by BHEL for submission of RCA	HSE & SA	0.5		Number of days delayed/Scheduled date is cut-off date intimated by BHEL	Daily Log Book entry/Incident Registers/letter references
#6.13	Non conductance of training (induction, job specific, height work etc.), tool box meeting and health check-up as per Contract requirements	HSE & SA	0.5		Number of incidences of non-conductance during the month	Daily Log Book entry/Incident Registers/letter references
Total			100			

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
SL	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents`
	Less Deduction in Score Due to Major Accidents (Fatal, Permanent Disability or bodily injury by which person injured is prevented to resume to work within 48 hours or more after accident,, Major Damage to Equipment etc.) @ 3 points/ accident					
	Less Deduction in Score Due to Minor Accidents(All Others) @ 1 point/ accident					
	Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @2 points in a month on verification any day					
	Final Score					

Performance Score Summary for the Month	Total Score	Score Obtained
QUALITY	10	
PERFORMANCE	50	
RESOURCES	20	
SITE INFRASTRUCTURE & SERVICE	5	
SITE FINANCE	5	
HSE & SA	10	
OTHERS (deductions if any)	0	
TOTAL	100	

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

 PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 2 of 6
Name of Project	Contract No.	
Name of Work	Name of Contractor	

PART- A: Contd.....

Note 1: In addition to the work planned as per Col. 'A', Contractor shall also make full efforts to minimize the 'Cumulative shortfall attributable to contractor upto the month' as mentioned in Col. 'B' by enhancing its resources, so as to achieve the completion of activities as per agreed schedule. In case contractor is not able to execute the entire shortfall, then BHEL 'Engineer in-charge', shall decide the priority of work to be executed and it shall be binding on the contractor.

Note 2: Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month = $[(\Sigma E - \Sigma B) / (\Sigma A - \Sigma D)] \times 100$
 In case, $(\Sigma E - \Sigma B)$ is negative, then it shall be treated as zero percent."

Note 3: Form 14 should include all items being planned in the current month, and all items against which shortfall was attributable to contractor till previous month. However, for practical reason, if it is not possible to mention some of the items in Form-14 being planned to be executed in this month, then also value of such items shall necessarily be included in calculation of Total Value.

Note 4: In case reason for shortfall attributable to contractor is w.r.t. T&P and Manpower, it should be in conformity with Part B1 and B2.

BHEL
 (Sign with name, designation and date)

CONTRACTOR
 (Sign with name, designation and date)

 PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR			Page 4 of 6
Name of Project		Contract No.		
Name of Work		Name of Contractor		

PART – B-2: PLAN/ REVIEW OF DEPLOYMENT OF MANPOWER FOR THE MONTH OF Date of Plan/ Review

CONTRACTOR'S SCOPE: -

SN.	Area of Work	Category of Labour	No. of Labour required as per category	Deployment Period (in days)	No. of Labour actually deployed	Actual Deployment Period (in days)	REMARKS (Works affected due to non-availability of labour)
			A	B	C	D	

Percentage of Manpower Deployed = $100 \times \Sigma(CxD) / \Sigma(AxB)$

BHEL

(Sign with name, designation and date)

CONTRACTOR

(Sign with name, designation and date)

Name of Project		Contract No.
Name of Work		Name of Contractor

PART – C: PLAN(PHYSICAL) FOR THE NEXT MONTH i.e.

[illegible]

Note 1: Planned quantity should be based on available/ expected fronts/ inputs in the next month

Note 2: “Original Planned Quantity” shall be as per latest jointly agreed programme between BHEL and Contractor before commencement of work or at the time of latest Time Extension, as the case may be.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 6 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – D: REASONS FOR SHORTEALL ATTRIBUTABLE TO BHEL IN RESPECT OF PLAN FOR THE MONTH.....

SN.	Description of Work (from Part-A)	Quantities Affected		Reasons for Shortfall attributable to BHEL	Agency responsible for reasons for Shortfall	Remarks (Supporting Documents in respect of agency responsible)
		(Physical Quantity)	Unit of Measu- rement			
1	2	3	4	5	6	7

Note1: Reasons for shortfall shall include non-availability of fronts/ drawings/ materials/ T&P (BHEL Scope)/ clearances etc. and other hindrances for which contractor is not responsible.

Note2: Agency responsible may be BHEL Site/ MUs/ Design Centre/ BHEL Customer/ other Contractors etc.

BHEL
(Sign with name, designation and date)

PROFORMA OF BANK GUARANTEE (in lieu of EARNEST MONEY)
(On non-Judicial paper of appropriate value)
(Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....

Date.....

To
(Employer's Name and Address)

.....

Dear Sirs,

In accordance with the terms and conditions of Invitation for Bids/Notice Inviting Tender No.....¹ (Tender Conditions), M/s. ² having its registered office at ³ (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of.....⁴ invited by Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035*

The Tender Conditions provide that the Tenderer shall pay a sum of Rs ⁵ as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of ⁶ is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,

we, the(Name & address of the Bank)
..... having our Head Office at
.....(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs.....⁶ (in words Rupees.....) without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. ⁶

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Tenderer in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said

Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tenderer or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

This Guarantee shall be irrevocable and shall remain in force upto and including.....⁷ and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ⁸ we shall be discharged from all liabilities under this Guarantee.

We, ... Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁶
- b) This Guarantee shall be valid up to ⁷
- c) Unless the Bank is served a written claim or demand on or before ⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, ... Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

(Signature of Authorised signatory)

Date.....

Place of Issue.....

¹ Details of the Invitation to Bid/Notice Inviting Tender (Tender Ref. No. Eg. - BHEL PSSR SCT XXXX)

² Name of Tenderer

³ REGISTERED Office Address of the Tenderer

⁴ Details of the Work i.e Tender Description

⁵ EMD Amount as mentioned in Notice Inviting Tender

⁶ BG Amount in words and Figures (BG Amount shall be Minimum of EMD amount less Rs. 2 Lakhs)

⁷ Validity Date

⁸ Date of Expiry of Claim Period (Claim Period shall be minimum of 3 Months after the validity date of Bank Guarantee)

Note:

- 1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
- 2. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
- b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

(On non-Judicial paper of appropriate value)

(Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....

Date.....

To

(Employer's Name and Address)

.....

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035* having agreed to exempt

_____ ¹ (Name of the Vendor / Contractor / Supplier) with its registered office at _____ ² (hereinafter called the said "Contractor" which term includes supplier), from demand under the terms and conditions of the Contract arising vide Letter of Intent (LOI) reference No. _____ dated _____ ³ valued at Rs. _____ ⁴ (Rupees _____ only) ⁴ (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs. _____ ⁵ (Rupees _____ only),

We, the (Name & address of the Bank) having our Head Office at (hereinafter referred to as the Bank), at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, an amount not exceeding Rs. _____ without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ ⁵.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force upto and including _____ ⁶ and shall be extended from time to time for such period as may

be desired by the Employer. Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁷, we shall be discharged from all the liability under this guarantee thereafter.

We, _____ (indicate the name of the Bank) further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁵
- b) This Guarantee shall be valid up to ⁶
- c) Unless the Bank is served a written claim or demand on or before _____⁷ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____
for _____ (indicate the name of the Bank)

(Signature of Authorised signatory)

¹ NAME OF VENDOR /CONTRACTOR / SUPPLIER

² REGISTERED OFFICE ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ LETTER OF INTENT(LOI) REFERENCE NO. WITH DATE

⁴ CONTRACT VALUE (AS MENTIONED IN LOI)

⁵ BG AMOUNT IN FIGURES AND WORDS

⁶ VALIDITY DATE

⁷ DATE OF EXPIRY OF CLAIM PERIOD (CLAIM PERIOD SHALL BE MINIMUM OF 3 MONTHS AFTER VALIDITY DATE)

Note:

1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:
2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings. If BHEL is to initiate Conciliation, then, the invitation to Conciliate shall be extended to the concerned Stakeholder in **Format 7** hereto. Where the stakeholder is to initiate the Conciliation, the notice for initiation of Conciliation shall be sent in **Format-8** hereto.
3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.
4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL. The appointment of Conciliator(s) shall be completed and communicated by the concerned Department/Group of BHEL Unit/Division/Region/Business Group to the other party and the Conciliator(s) within 30 days from the date of acceptance of the invitation to conciliate by the concerned party in the **Format-9**. The details of the Claim, and counter-claim, if any, shall be intimated to the Conciliator(s) simultaneously in **Format-5**.
5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.
6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.

- 7.** The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within 15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the earliest but in any case within 1 month from the date of conclusion of the last hearing.
- 8.** Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.
- 9.** In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.
- 10.** Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.
- 11.** When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.
- 12.** In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.
- 13.** Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.
- 14.** In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after

seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.

- 15.** The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given by the IEC to both the parties for putting up for approval of their respective Competent Authority.
- 16.** Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.
- 17.** In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.
- 18.** A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.
- 19.** The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.
- 20.** Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.
- 21.** Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged

absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.

22. The proceedings of Conciliation under this Scheme may be terminated as follows:

- a.** On the date of signing of the Settlement agreement by the Parties; or,
- b.** By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,
- c.** By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- d.** By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- e.** On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

Sl No	Particulars	Amount
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator) In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator)

Sl No	Particulars	Amount
		In cases involving claim and/or counter-claim of more than Rs 10 crores. Rs 1,00,000/- (per Conciliator) Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on the, Signing of the Settlement Agreement after approval of the Competent Authority or Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.
3	Secretarial expenses	Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC. Where Conciliation is by multi member Conciliators –Rs 30,000/- (one time)- to be paid to the IEC
4	Travel and transportation and stay at outstation Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	As per the extant entitlement of whole time Functional Directors in BHEL. Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region /

Sl No	Particulars	Amount
		Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place/venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

- 24.** The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s) on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.
- 25.** If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.
- 26.** The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.
- 27.** Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.
- 28.** The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 4 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.
- 29.** The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement,

except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.

- 30.** The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:
- a.** Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
 - b.** admissions made by the other party in the course of the Conciliator proceedings;
 - c.** proposals made by the Conciliator;
 - d.** The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.
- 31.** The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
- 32.** None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
- 33.** The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.
- 34.** The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

**STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE
IEC BY BOTH THE PARTIES**

1. Chronology of the Disputes
2. Brief of the Contract/MoU/Agreement/LOI/LOA
3. Brief history of the Disputes:
4. Issues:
5. Details of Claim(s)/Counter Claim(s):

SI. No.	Description of claim(s)/Counter Claim	Amount (in INR)Or currency applicable in the contract	Relevant contract clause

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note– *The Statement of Claims/ Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/ Counter Claims. The statement of Claims/ Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY BHEL FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE CONTRACT BY BHEL**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which arise out of the above- referred Contract/MoU/Agreement/LOI/LOA are reproduced hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring disputes to conciliation.

In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby seek your consent to refer the matter to Conciliation by Independent Experts Committee to be appointed by BHEL. You are invited to provide your consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which you might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA.

Please note that upon receipt of your consent in writing within 30 days of the date of receipt of this letter by you, BHEL shall appoint suitable person(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you
Yours faithfully

Representative of BHEL

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

**FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY A
STAKEHOLDER FOR REFERRING THE DISPUTES TO CONCILIATION
THROUGH IEC**

To,

BHEL (Head of the Unit/Division/Region/Business Group)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE
CONTRACT BY A STAKEHOLDER**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which have arisen out of the above-referred Contract/MoU/Agreement/LOI/LOA are enumerated hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring inter-se disputes of the Parties to conciliation.

We wish to refer the above-said disputes to Conciliation as per the said Clause of the captioned Contract/MoU/Agreement/LOI/ LOA. In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby invite BHEL to provide its consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which it might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA and to appoint suitable person(s) as Conciliator(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you
Yours faithfully

Representative of the Stakeholder

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT FOR INTIMATION TO THE STAKEHOLDER ABOUT APPOINTMENT OF CONCILIATOR/IEC

To,

M/s. (Stakeholder's name)

Subject: **INTIMATION BY BHEL TO THE STAKEHOLDER AND CONCILIATOR(S) ABOUT APPOINTMENT OF CONCILIATOR/IEC**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

This is with reference to letter dated ----- regarding reference of the disputes arising in connection with the subject Contract No /MoU/Agreement/LOI/LOA to conciliation and appointment of Conciliator(s).

In pursuance of the said letter, the said disputes are assigned to conciliation and the following persons are nominated as Conciliator(s) for conciliating and assisting the Parties to amicably resolve the disputes in terms of the Arbitration & Conciliation Act, 1996 and the Procedure ---- to the subject Contract/MoU/Agreement/LOI/LOA, if possible.

Name and contact details of Conciliator(s)

a)

b)

c)

You are requested to submit the Statement of Claims or Counter-Claims (strike off whichever is inapplicable) before the Conciliator(s) in Format 5 (enclosed herewith) as per the time limit as prescribed by the Conciliator(s).

Yours faithfully,

Representative of BHEL

CC: To Conciliator(s)... for Kind Information please.

Encl: As above

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

ПЛАН ПОЛОВ НА ОТМЕТКЕ 0,000 В ОСЯХ D-E
ОТМЕТКИ УРОВНЕЙ ПОЛОВ
PLAN OF THE FLOORS AT ELEVATION 0,000 IN AXES D-E
ELEVATIONS OF FLOORS LEVEL

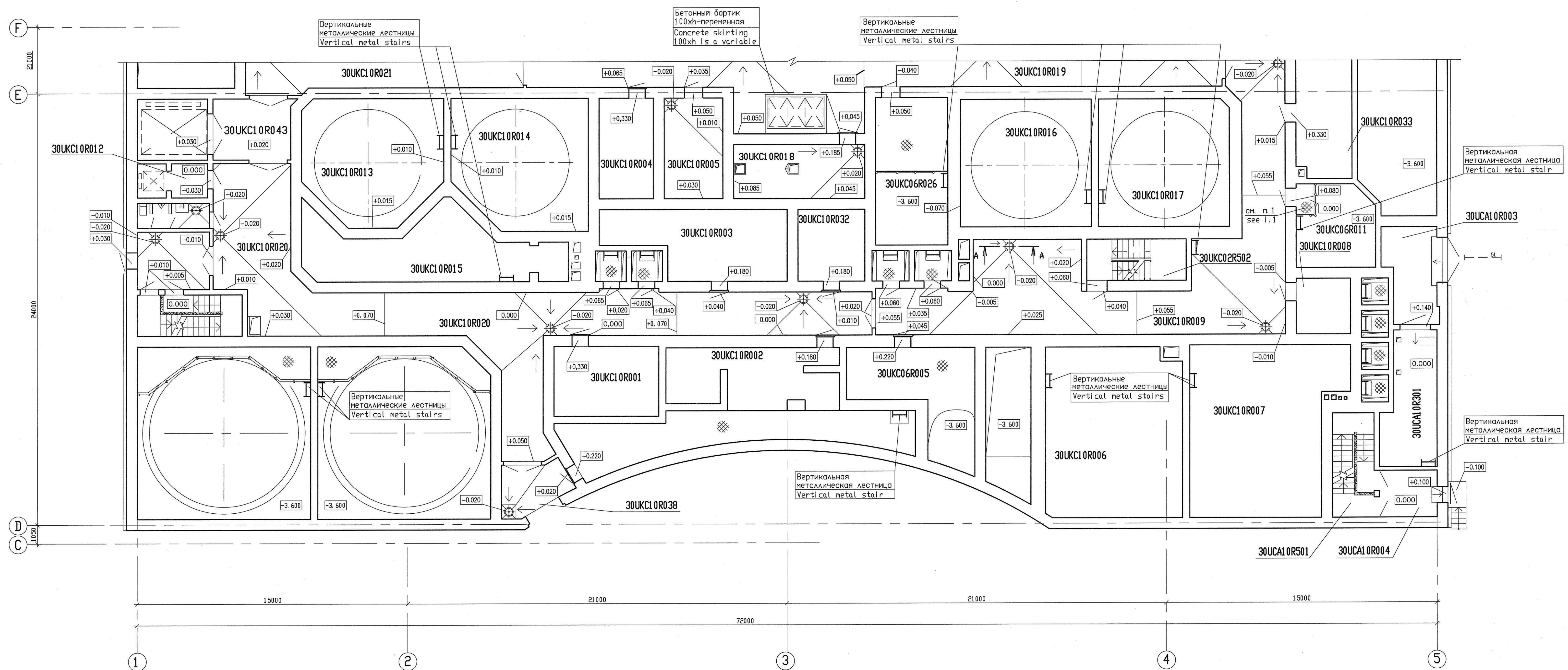
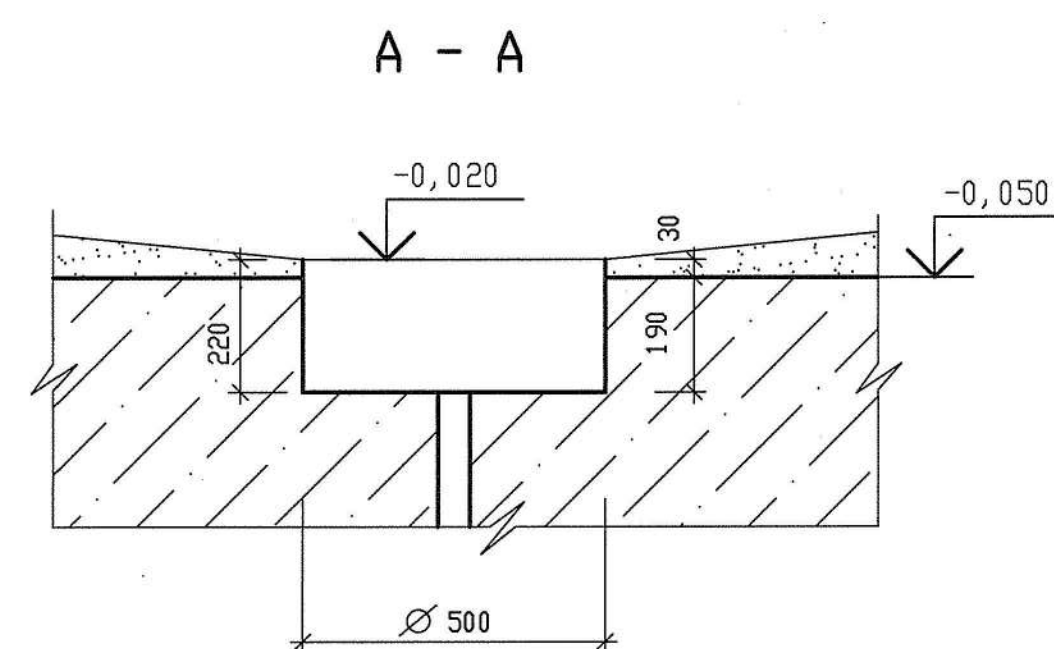
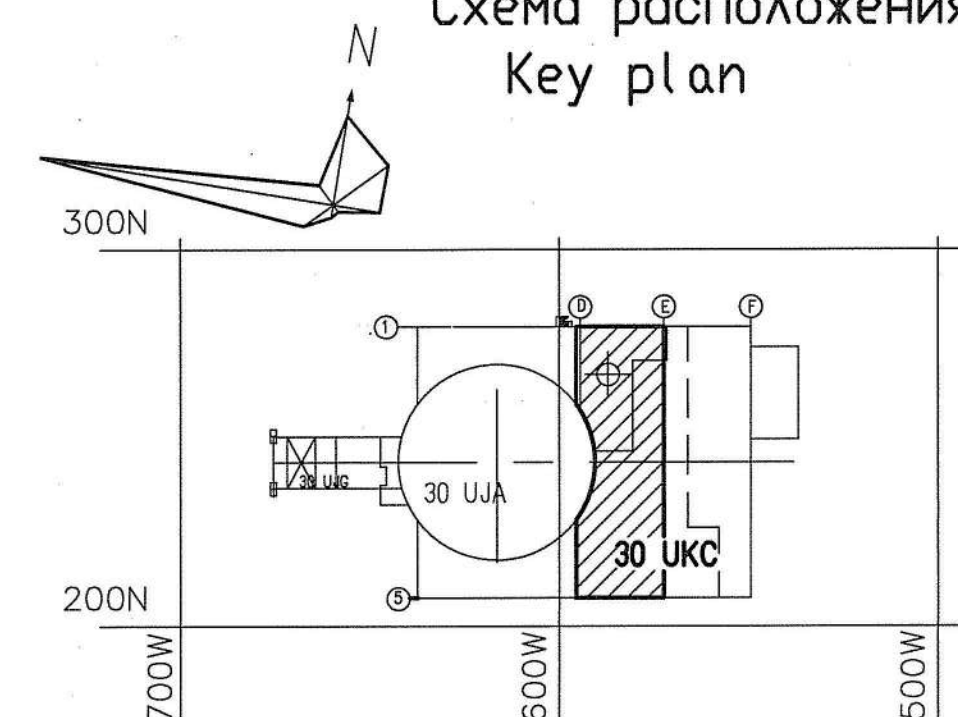


Схема расположения
Key plan



Package Number 3 6 2 56

File: R01 KK34 30UKC 0 AR DK WD005_002=0

R01. KK34. 30UKC. 0. AR. ☐ K. WD005

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JSC "Atomenergoproekt"

Изм.	Кол. уч.	Лист	N док.	Погнучь	Дат
Rev.	Qty. pers.	Sheet	Doc. No	Signature	Da
Умбердия Approved Н. контр. Inspector Разрѣб.		Voronova	Semi na	<i>Борис</i>	26
		Isakov		<i>Исак</i>	27

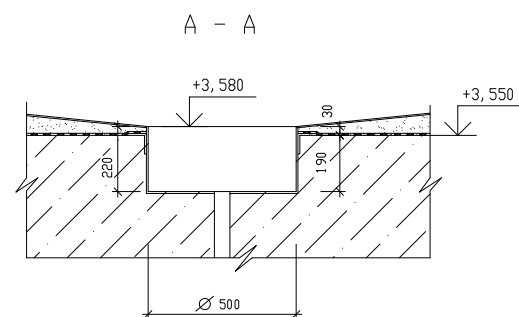
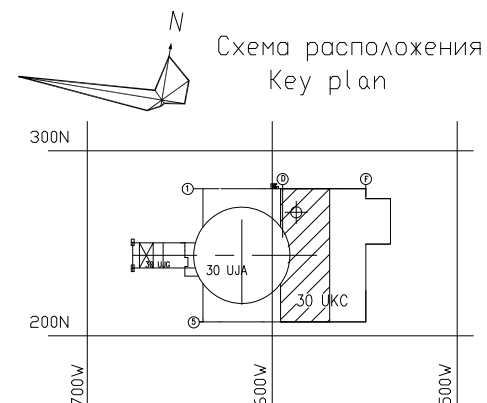
Р01	КК34. 30UKC. 0	АЭС "КУДАНКУЛА" NPP "KUDANKULAN"
30UKC	Вспомогательное реакторное здание с БПЦ. Полы и фундаменты для оборудования до отметки +3,60.	30UKC Reactor Auxiliary & Main Control Room Building.Floors and foundations for the equipment up to elevation +3,60. Plan at elevation 0,00
30UKC	Полы пола на отметке 0,00 в осях Д-Е. Отметки уровня полов	Plan of the floors at elevation 0,00 in axes D-E. Floors Level

AR. UK. WD005 БЛОК UNIT 3		
Стадия	Лист	Листов
Phase	Sheet	Sheets
WD	2	
JSC "Atomenergoproekt" Moscow 2017		

Формат/Size A2x3

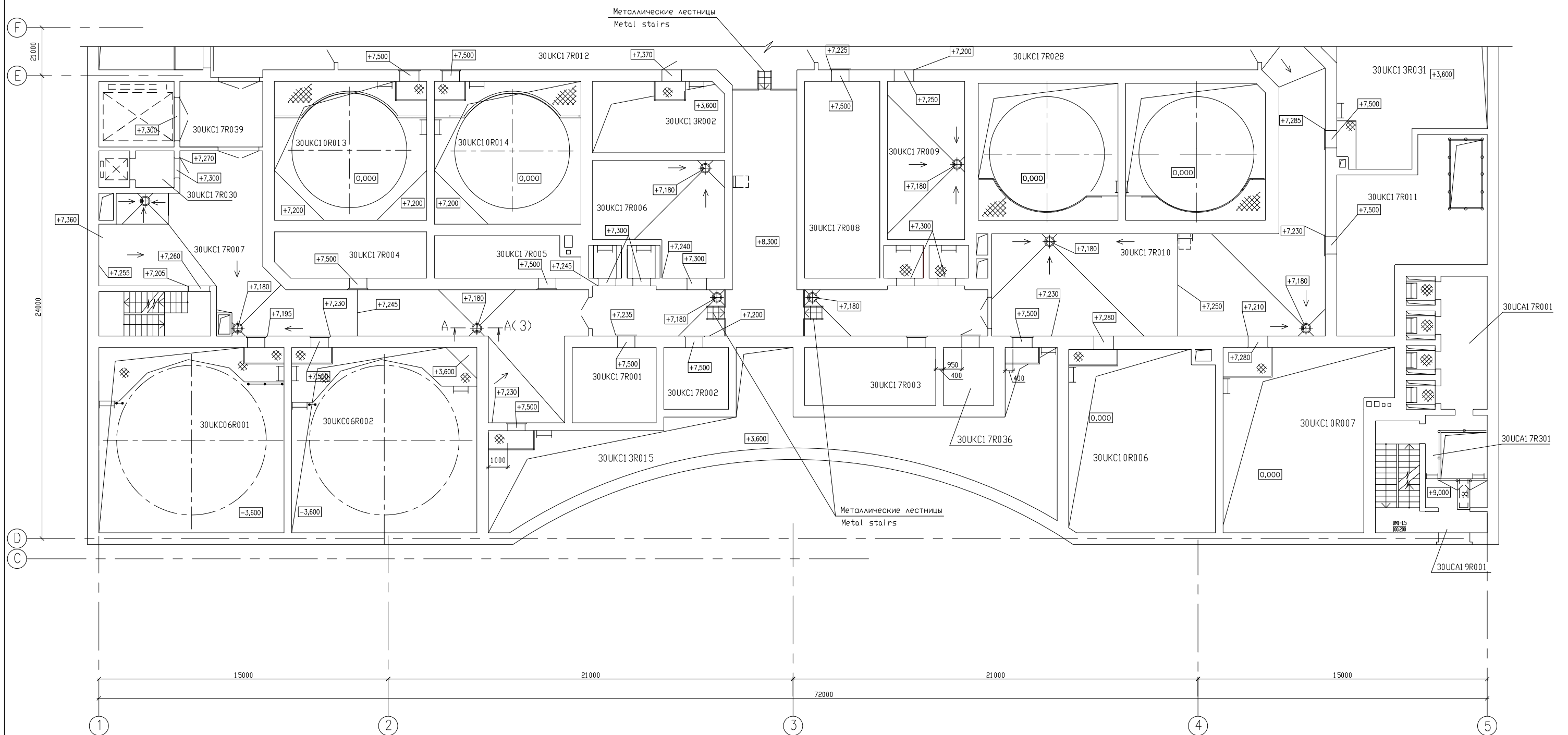
Architectural site plan of a wastewater treatment plant (WWTP) showing various treatment units, circular tanks, and rectangular basins. The plan includes elevation markers, unit identifiers (e.g., 30UKC1 3R009, 30UKC1 0R013), and a coordinate grid (A-E, 1-5). A note indicates "Бетонный бортик 100хх-переменная Concrete skirting 100xh is a variable".

1 For the structures of metal landings and staircases see drawings of "KM" mark (package 3 7 2 66).



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								АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 3			
								30 UKC. Полы и фундаменты для оборудования на отметках +3,600 и +7,200	Стрелка	Лист	Листов
							План на отметке +3,600	Phase	Sheet	Sheets	
							30 UKC. Floors and Foundations for the equipment at elevations +3,600 and +7,200	WD	2		
							Plan at elevation +3,600				
	Изм.	Кол. уч.	Лист	N год	Подпись	Дата					
	Rev.	Qty. pers.	Sheet	Doc. No	Signature	Date					
	Утвердил										
	Approved		Voronova								
	Н. контр. Инспектор		Semina								
	Разработ.		Isakov								
	Designed										
							План пола на отметке +3,600 в осях D-E. Отметки уровня пола Plan of the floor at elevation +3,600 in axes D-E. Elevations of floors levels				
							 JSC "Atomenergoproekt" Moscow 2017				

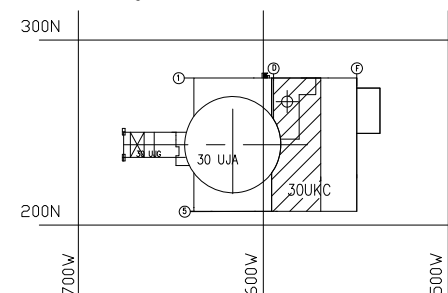
ПЛАН ПОЛА НА ОТМЕТКЕ +7,200 В ОСЯХ D-E
ОТМЕТКИ УРОВНЕЙ ПОЛОВ
PLAN OF THE FLOOR AT ELEVATION +7,200 IN AXES D-E
ELEVATIONS OF FLOORS LEVELS




 N Схема расположения
Key plan

1 Конструкции металлических площадок и лестниц смотрите чертежи марки "КМ" (пакет 3 8 2 49).

1 For the structures of metal landings and staircases see drawings of "KM" mark (package 3 8 2 49).



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							R01.KK34. 30UKC.O.AR.OK.WD009		
							АЭС "КУДАНКУЛАМ" БЛОК 3		
							NPP "KUDANKULAM" UNIT		
Изм.	Кол. уч.	Лист	N	год.	Подпись	Дата	30 UK. Полы и фундаменты для оборудования на отметках +3,600 и +7,200		
Rev.	Qty. pers.	Sheet	Doc. No		Signature	Date	План на отметке +7,200		
							30 UKC. Floors and foundations for the equipment at elevations +3,600 and +7,200		
Умбэргал							Стация	Лист	Листов
Approved		Voronova					Phase	Sheet	Sheets
Н. контр. Инспектор		Semi na					WD	2	
Разраб.		Isakov					JSC "Atomenergoproekt" Moscow 2017		
Designed									

Package Number 3 7 2 67
File: R01KK3430UKCOAROKWD009_002=0

R01.KK34. 30UKC.0.AR.OK.WD009

АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT	3

30 UKC. Полы и фундаменты для оборудования на отметках +3,600 и +7,200 План на отметке +7,200	Стаяга	Лист	Листов
30 UKC. Floors and foundations for	Phase	Sheet	Sheets

the equipment at elevations +3,600 and +7,200	WD	2	
Plan at elevation +7,200			

plan of the floor at elevation +7,200
in axes D-E.
elevations of floors levels

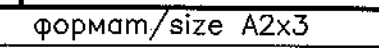
формат A1

Orig. arch. Nr.	Date	Replace arch. Nr.

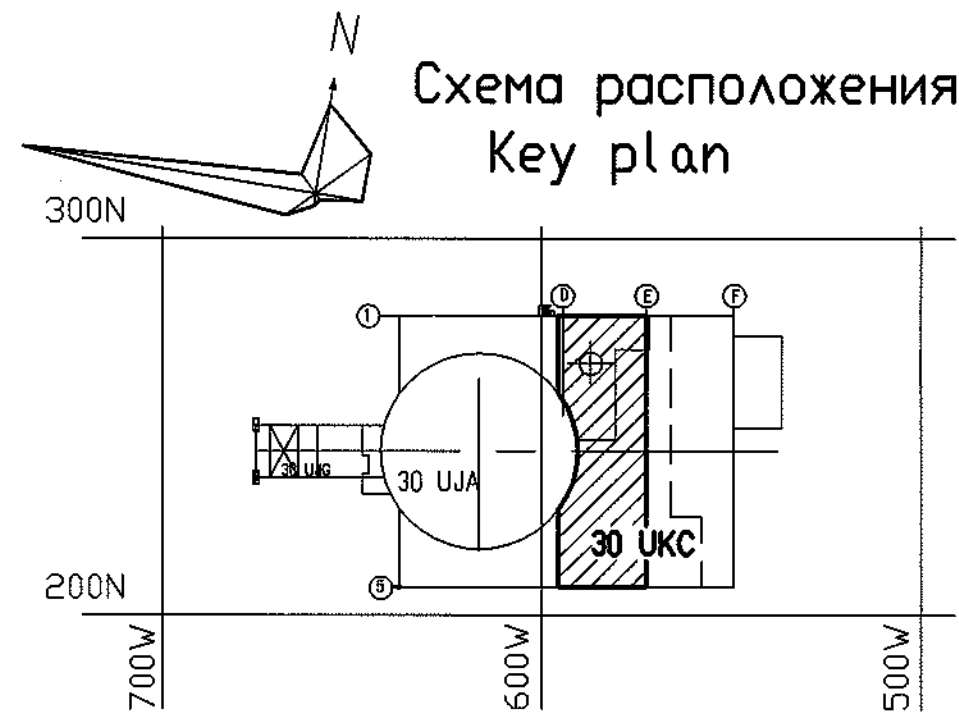
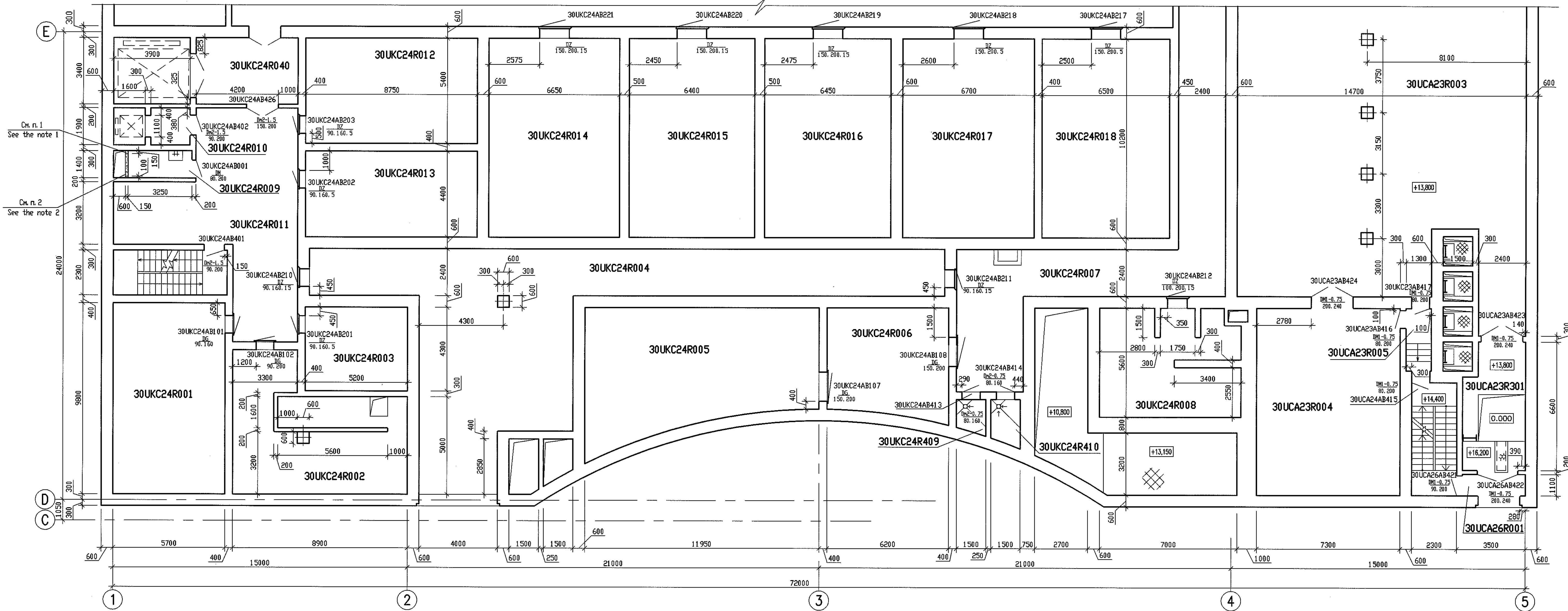
Date _____

l. Nr.	

ФРАГМЕНТ 1
FRAGMENT 1



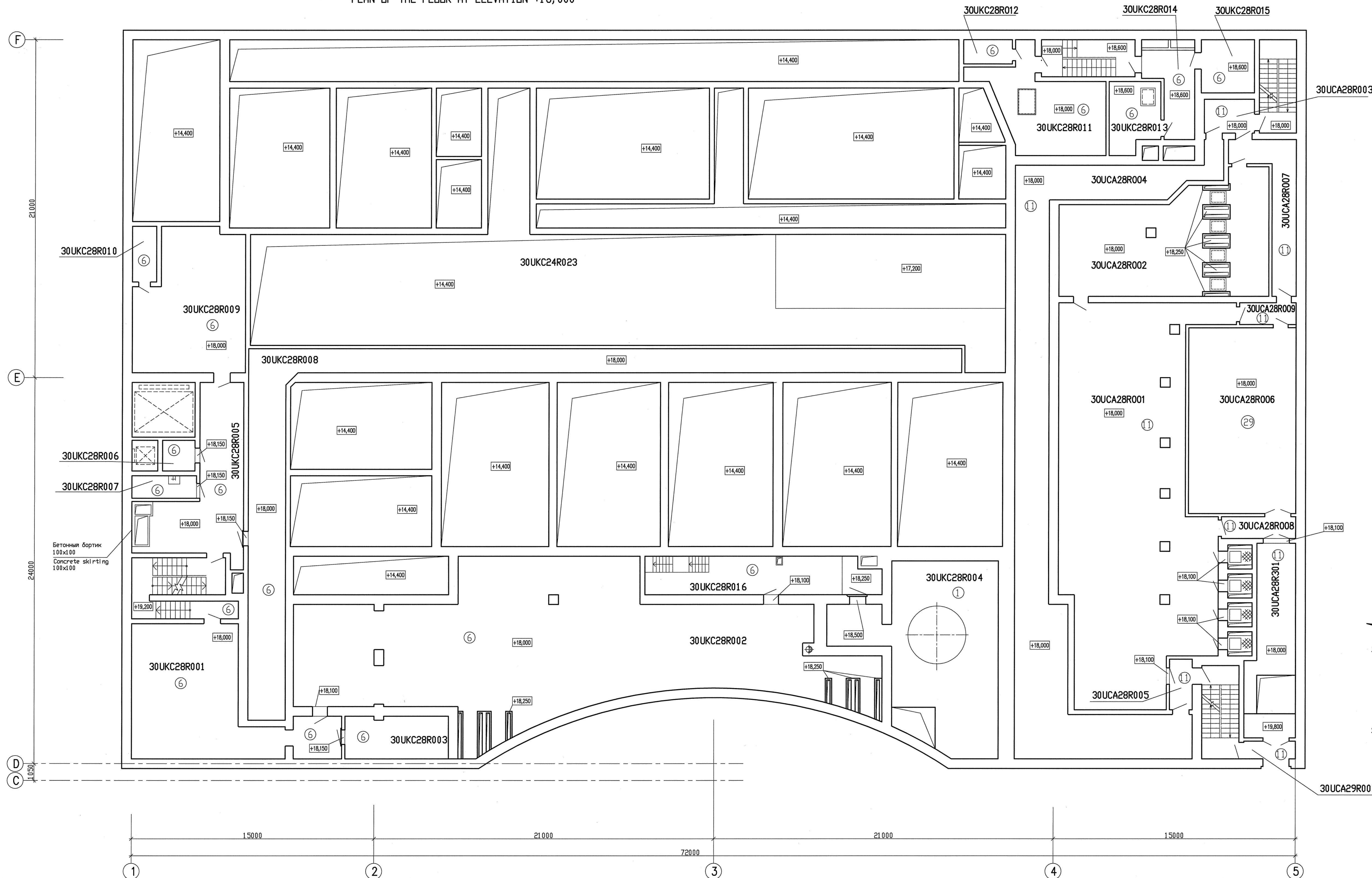
ПЛАН НА ОТМЕТКАХ +13,800 И +14,400 В ОСЯХ D-E
PLAN AT ELEVATIONS +13,800 AND +14,400 IN AXES D-E



- 1 Отверстие WK 150x1000 низ на отметке +14,750.
1 150x100 opening (water supply and sewerage systems)
with the bottom at elevation of +14,750.
- 2 Отверстие OW 200x200 низ на отметке +17,150 обрмить L 50x50x5.
2 200x200 opening (heating and ventilation systems)
with the bottom at elevation of +17,150 shall be set in 50x50x5 frame.
- 3 Конструкции металлических площадок и лестниц смотрите чертежи
марки "KM" (пакет 3 10 2 22).
3 For the structures of metal landings and staircases see
drawings of "KM" mark (package 3 10 2 22).

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						АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 3				
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	Rev.	Qty. pat.	Sheet	Doc. No.	Signature	Date	30UKC. Reactor Auxiliary & Main Control Room Building. Architectural layout drawings at elevations +10,800, +13,800, +14,400. Plan at elevation +14,400.			
	Утвержден		Voronova				План на отметках +13,800 и +14,400 в осях D-E			
	Н. комп. инспектор		Semina				План на отметках +13,800 и +14,400 в осях D-E			
	Разработ.		Isakov				План на отметках +13,800 и +14,400 в осях D-E			
Designed										
							JSC "Atomenergoproekt" Moscow 2018			
							формат/size A1			

ПЛАН ПОЛА НА ОТМЕТКЕ +18,000
PLAN OF THE FLOOR AT ELEVATION +18,000



ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF ROOMS

Номер помещения No of compartment	Наименование Description	Площадь Area, m ²	Категория Category of compartment
	Здание УКС Building UKC		
30UKC28R001	Коридор Corridor	70,0	B2
30UKC28R002	Кабельный этаж перевалочной машины и полярного крана Cable floor of refueling machine and polar crane	10,7	B1
30UKC28R003	Помещение радиоконтроля Radiation monitoring room	16,9	B4
30UKC28R004	Помещение газаратора попутной воды Makeup water deaerator room	89,1	B2
30UKC28R005	Коридор Corridor	42,9	-
30UKC28R006	Резервное помещение Standby compartment	3,8	д
30UKC28R007	Кладовая уборочного инвентаря Store room for cleaning tools	4,6	д
30UKC28R008	Венткороб Air channel	116,1	-
30UKC28R009	Венткамера противодымной защиты Smoke protection ventilation chamber	56,1	д
30UKC28R010	Воздухозаборная камера Air intake chamber	5,2	-
30UKC28R011	Камера противодымной защиты Smoke protection chamber	34,9	д
30UKC28R012	Воздухозаборная камера Air intake chamber	4,5	-
30UKC28R013	Машинное отделение лифта Engine room of lift	11,5	B4
30UKC28R014	Коридор Corridor	13,0	B4
30UKC28R015	Помещение вентрезерваторов системы KLE28 KLE28 system ventilation unit room	10,9	д
30UKC28R016	Коридор Corridor	34,0	B1

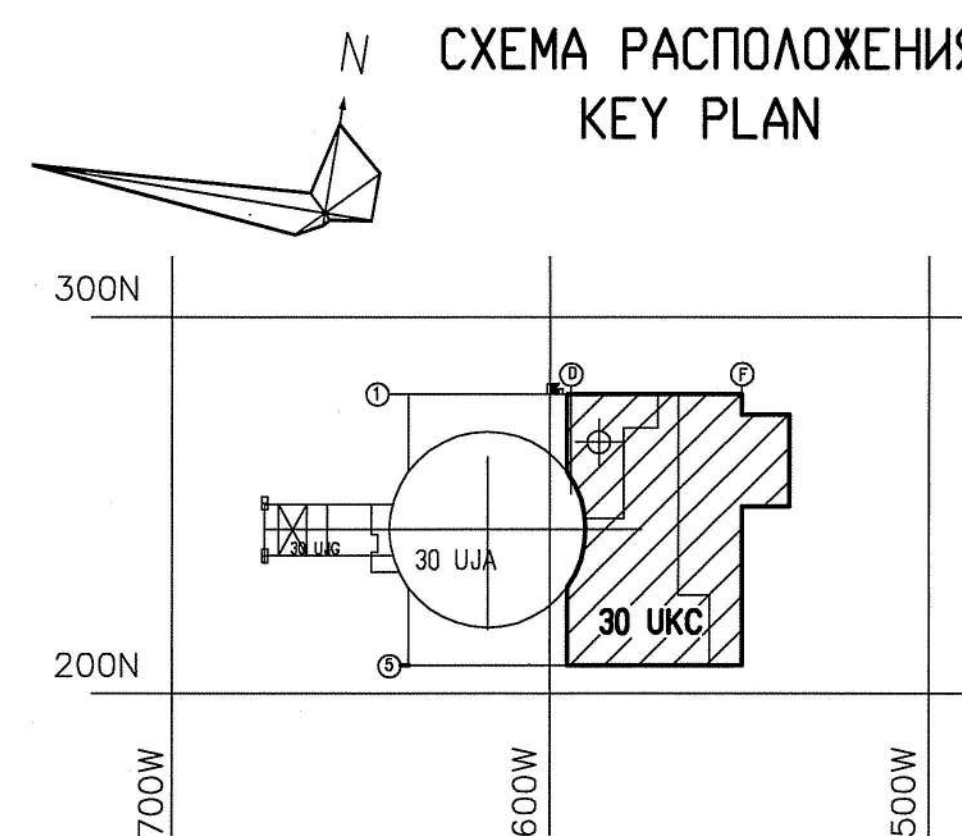
Номер помещения No of compartment	Наименование Description	Площадь Area, m ²	Категория Category of compartment
	Здание УКА Building UCA		
30UCA28R001	Кабельный этаж системы безопасности Cable floor of safety system	209,7	B1
30UCA28R002	Кабельный этаж нормальной эксплуатации Cable floor of normal operation	83,7	B1
30UCA28R003	Тамбур Tambour	6,5	-
30UCA28R004	Коридор для воздуховодов Corridor for air ducts	131,8	B1
30UCA28R005	Тамбур Tambour	12,5	-
30UCA28R006	Помещение шкафов преобразователей КИП для представления на БПУ ЗСД &C converter cabinet room for display to MCR	76,8	B2
30UCA28R007	Коридор Corridor	18,7	-
30UCA28R008	Тамбур Tambour	19,6	-
30UCA28R009	Тамбур Tambour	4,7	-
30UCA28R001	Транспортная шахта Equipment shaft	32,9	-
30UCA28R001	Тамбур Tambour	3,5	-

* Категория по взрывопожарной и пожарной опасности
* Explosion and fire hazard category

ЗКД-II - периодически обслуживаемые помещения "зоны контролируемого доступа"
CAA-II - periodically attended rooms of "controlled access area"

ЗСД - помещения "зоны свободного доступа"
CmAA - rooms of "common access area"

СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



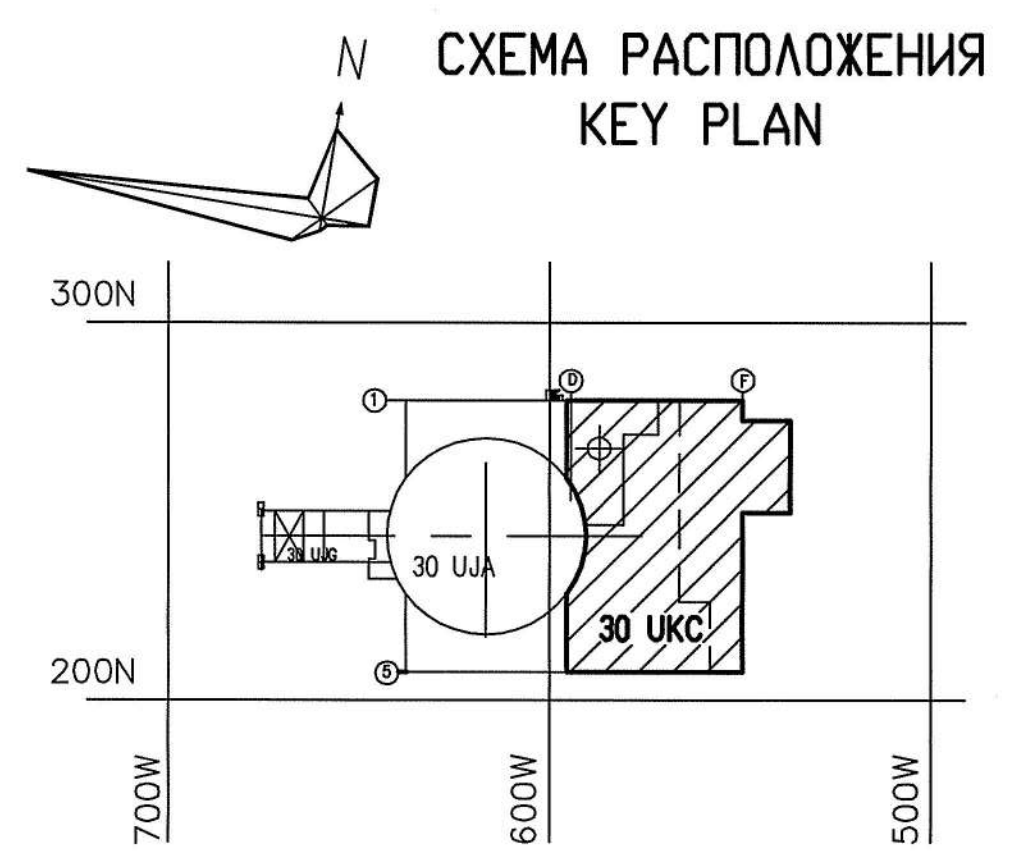
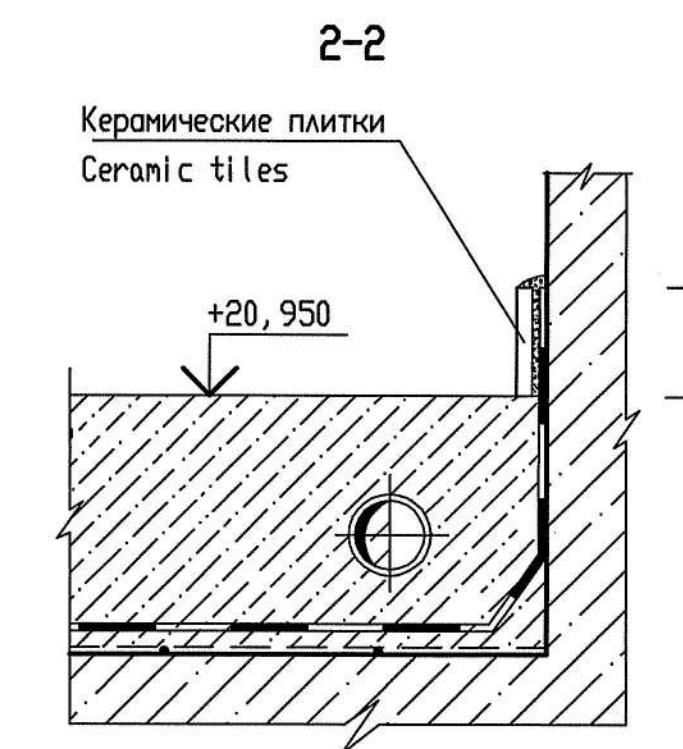
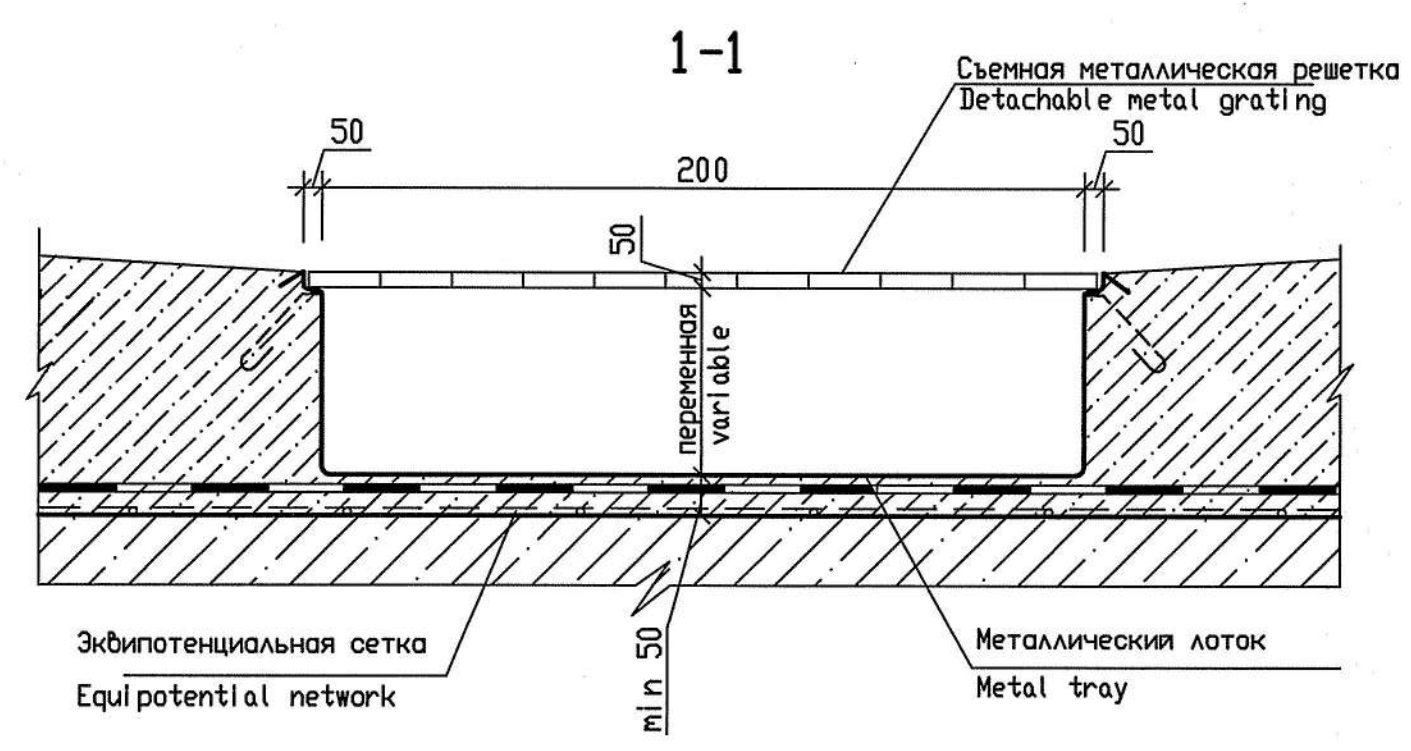
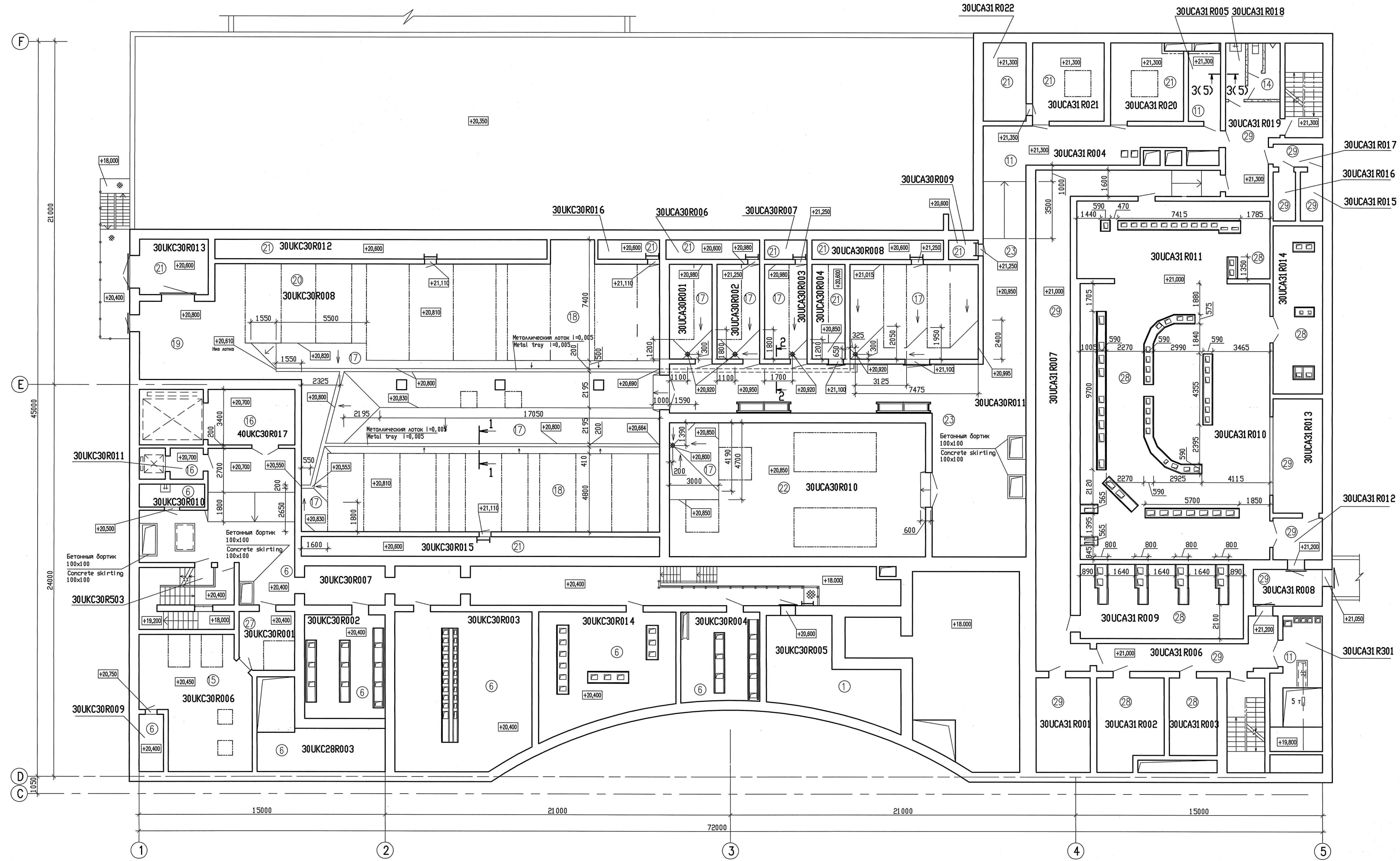
Package Number 3 12 2 38
File: R01.KK34.30UKC.0.AR.OK.WD015_002=0

R01.KK34.30UKC.0.AR.OK.WD015
АЭС "КУДАНКУЛАМ" БЛОК 3
NPP "KUDANKULAM" UNIT 3

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	Утвержден Approved			Vorontsov	И.И. Воронцов	11.10.18	План пола на отметке +18,000. Экспликация помещений. Plan of the floor at elevation +18,000. Explication of compartments	Phase WD	2	JSC "Atomenergoproekt" Moscow 2018
	Н. комп. Inspector			Semina	С.А. Семина	11.10.18				
	Разработ. Designed			Isakov	И.А. Исаков	11.10.18				

формат A2x3

ПЛАН ПОЛА НА ОТМЕТКАХ +20,400 и +21,000
PLAN OF FLOOR AT ELEVATIONS +20,400 и +21,000



Спец. арх. № 28.8.17
Date 19.07.2018
Replaces sheet №

Package Number 3 12 2 38
File: R01.KK34.30UKC.0.AR.OK.WD017_002=0

Р01.KK34.30UKC.0.AR.OK.WD017
АЭС "КУДАНКУЛАМ" БЛОК
NPP "KUDANKULAM" UNIT 3

30UKC. Вспомогательное реакторное здание с
51V. Планы и фундаменты для оборудования на
отметках +18,000; +20,400; +21,000; +24,600.
Планы на отметках +20,400 и +21,000
30UKC. Reactor Auxiliary & Main Control Room
Building. Plans and foundations for the equipment
at elevations +18,000; +20,400; +21,000; +24,600.
Plan at elevations +20,400 and +21,000

Статус
Phase
WD
Лист
Sheet
2
Листов
Sheets

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Изм.
Rev.
Утвердил
Approved
Н. комп.
Inspector
Разработ.
Designed
Кол-во
Qty
pers.
Sheet
No
Voronova
Semina
Isakov
Лист
Doc.
No
Signature
Date
15.11

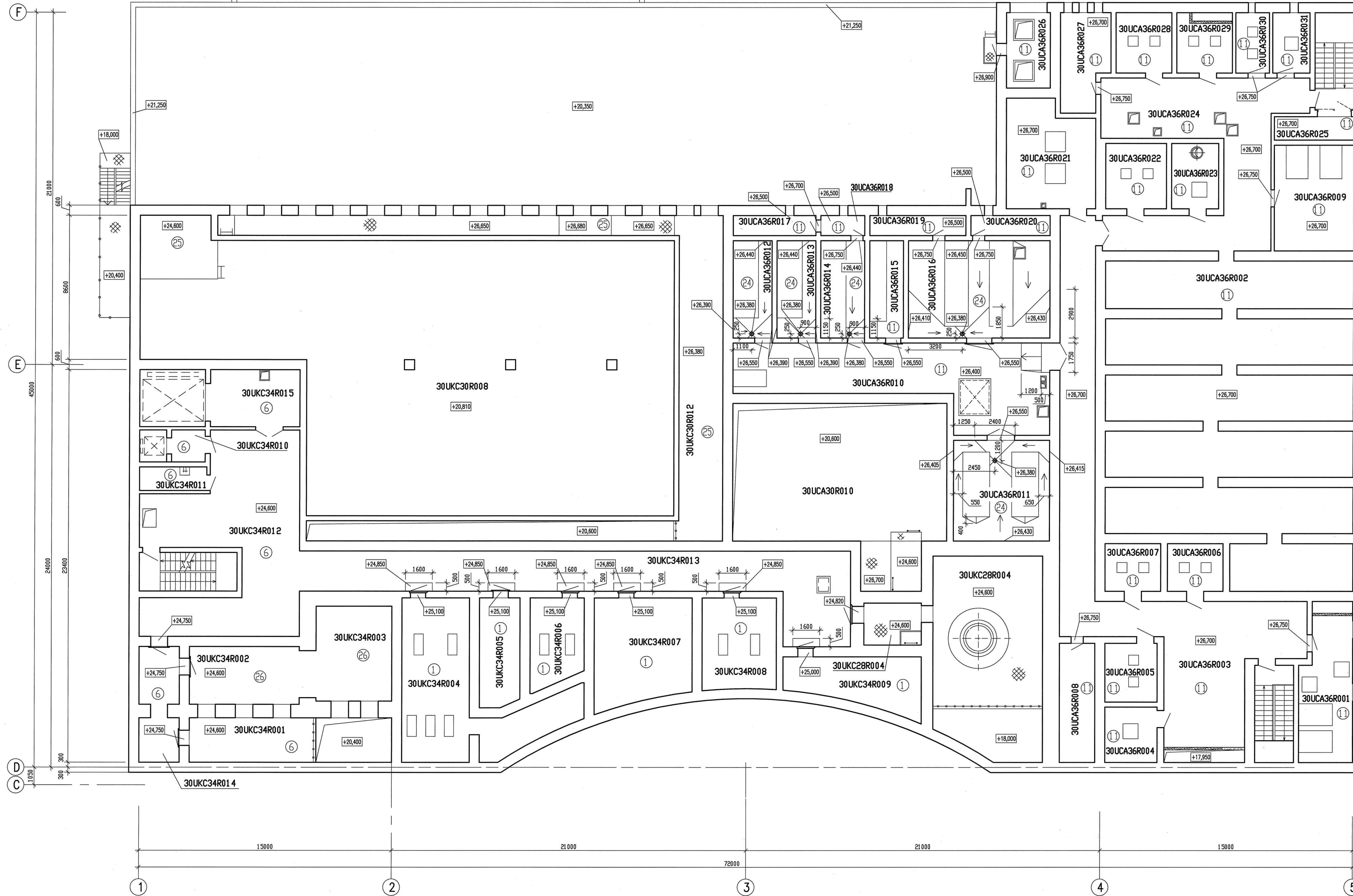
30UKC. Вспомогательное реакторное здание с
51V. Планы и фундаменты для оборудования на
отметках +18,000; +20,400; +21,000; +24,600.
Планы на отметках +20,400 и +21,000
30UKC. Reactor Auxiliary & Main Control Room
Building. Plans and foundations for the equipment
at elevations +18,000; +20,400; +21,000; +24,600.
Plan at elevations +20,400 and +21,000

План пола на отметках +20,400 и +21,000.
Сечения 1-1, 2-2
Plan of floor at elevations +20,400 and
+21,000. Sections 1-1, 2-2

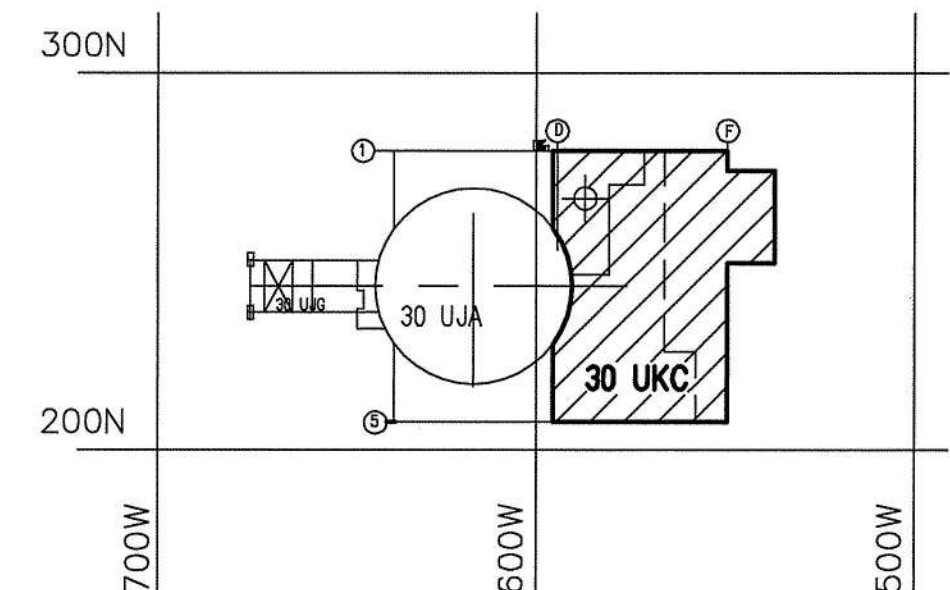
АО "Атомэнергoproject"
Moscow 2018

формат A2x3

ПЛАН ПОЛА НА ОТМЕТКАХ +24,600; +26,700
PLAN OF THE FLOOR AT ELEVATION +24.600, +26.700



N
↑
SCHEMA RASPOLOZHENIYA
KEY PLAN



Package Number 3 12 2 38
File: R01 KK34 30UKC 0 AR OK WD019_002=0

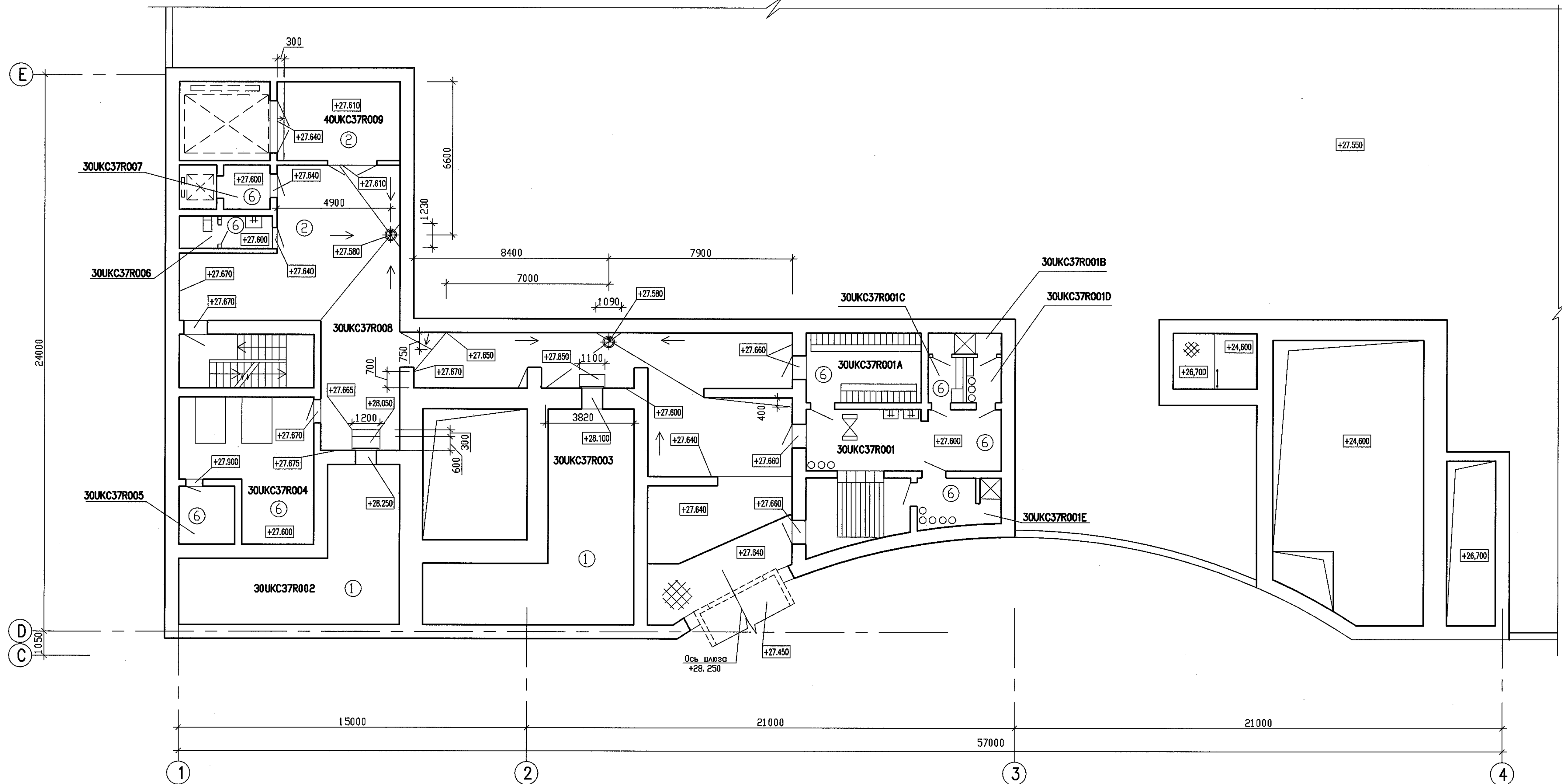
Данный чертеж
не подлежит размножению
или передаче другим
организациям и лицам
без согласия АО
"Атомэнергoproject"

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							R01.KK34.30UKC.0.AR.OK.WD019						
							АЭС "КУДАНКУЛАМ" БЛОК 3 НРР "КУДАНКУЛАМ" УНП 3						
Изм.	Колуч.	Лист	N	год	Подпись	Дата	30UKC. Вспомогательные реакторные здания с 30UKC. Reactor auxiliary buildings with отеплитель +18,000; +20,400; +21,000; +24,600 отеплитель +18,000; +20,400; +21,000; +24,600 Plan of elevations +24,600; +26,700				Страницы	Лист	Листов
Rev.	Qty pers.	Sheet	Doc. No		Signature	Date	30UKC. Reactor auxiliary buildings with Heating, floors and foundations for the equipment at elevations +18,000; +20,400; +21,000; +24,600. Plan at elevations +24,600; +26,700				Phase	Sheet	Sheets
Утверждено Approved					Voronova	15.10.18					WD	2	
Инспектор Inspected					Semina	15.10.18	План пола на elevations +24,600; +26,700 Plan of floor at elevation +24,600; +26,700				JSC "Atomenergoproekt" Moscow 2018		
Разработ. Designed					Isakov	15.10.18							

формат A2x3

ПЛАН НА ОТМЕТКЕ +27,600
PLAN AT ELEVATION +27.600

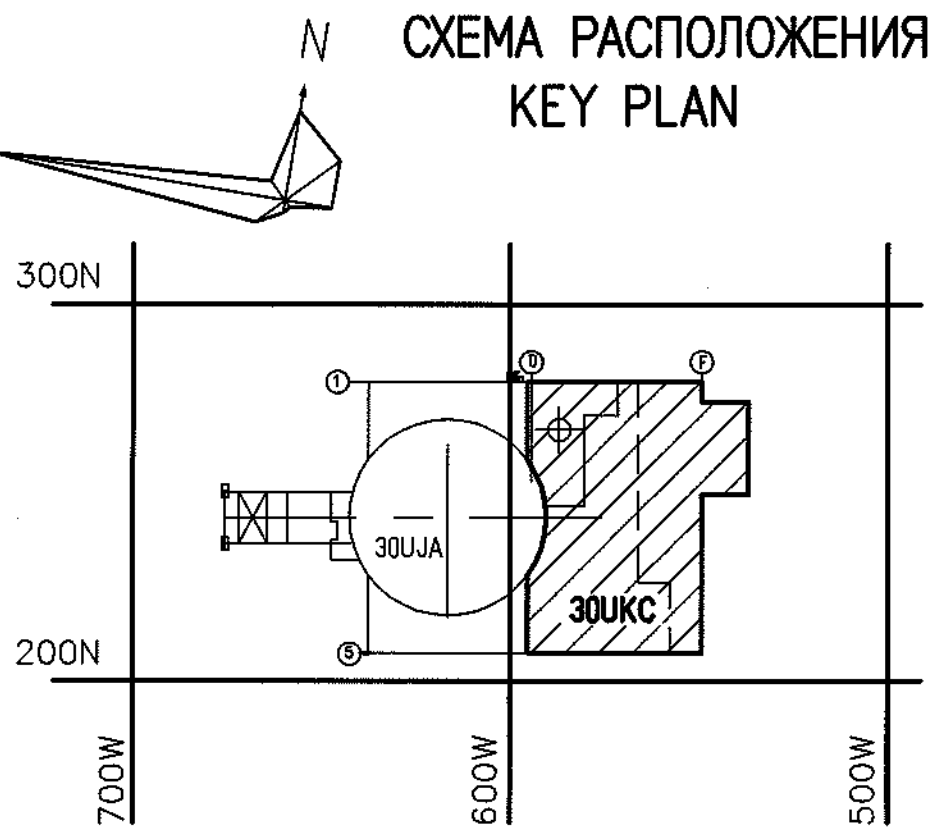


ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF COMPARTMENTS

Номер помеще-ния No of com-part.	Наименование Description	Площадь m² Area, m²	Кат. помеще-ния Cate-gory of compart.
	Здание UKC Building UKC		
30UKC37R001	Помещение дозиметрического контроля и очистки обуви Room for dosimetry control and footwear cleaning	36,0	Д
30UKC37R001A	Помещение чистой одежды и средств индивидуальной защиты Room for clean clothes and personal protection equipment	14,9	-
30UKC37R001B	Душевая Shower room	2,8	-
30UKC37R001C	Прегдушевая Compartment before shower room	2,9	-
30UKC37R001D	Прегдушевая Compartment before shower room	2,9	-
30UKC37R001E	Помещение обмыва пластиковой одежды Room for plastic clothes washing	7,6	-
30UKC37R002	Помещение радиационного контроля выбросов Compartment for releases radiation monitoring	39,6	В4
30UKC37R003	Помещение радиационного контроля выбросов Compartment for releases radiation monitoring	48,7	Д
30UKC37R004	Венткамера противодымной защиты Smoke protection ventilation chamber	29,3	Д
30UKC37R005	Воздухозаборная камера Air intake chamber	6,0	-
30UKC37R006	Санузел Lavatory	4,6	-
30UKC37R007	Тамбур лифта Lift tambour	3,8	-
30UKC37R008	Коридор Corridor	160,7	В2
40UKC37R009	Коридор Corridor	18,0	-

* Категория по взрывопожарной и пожарной опасности
* Explosion and fire hazard category

ЗКД-II - периодически обслуживаемые помещения "зоны контролируемого доступа"
CnAA-II - periodically attended rooms of "controlled access area"

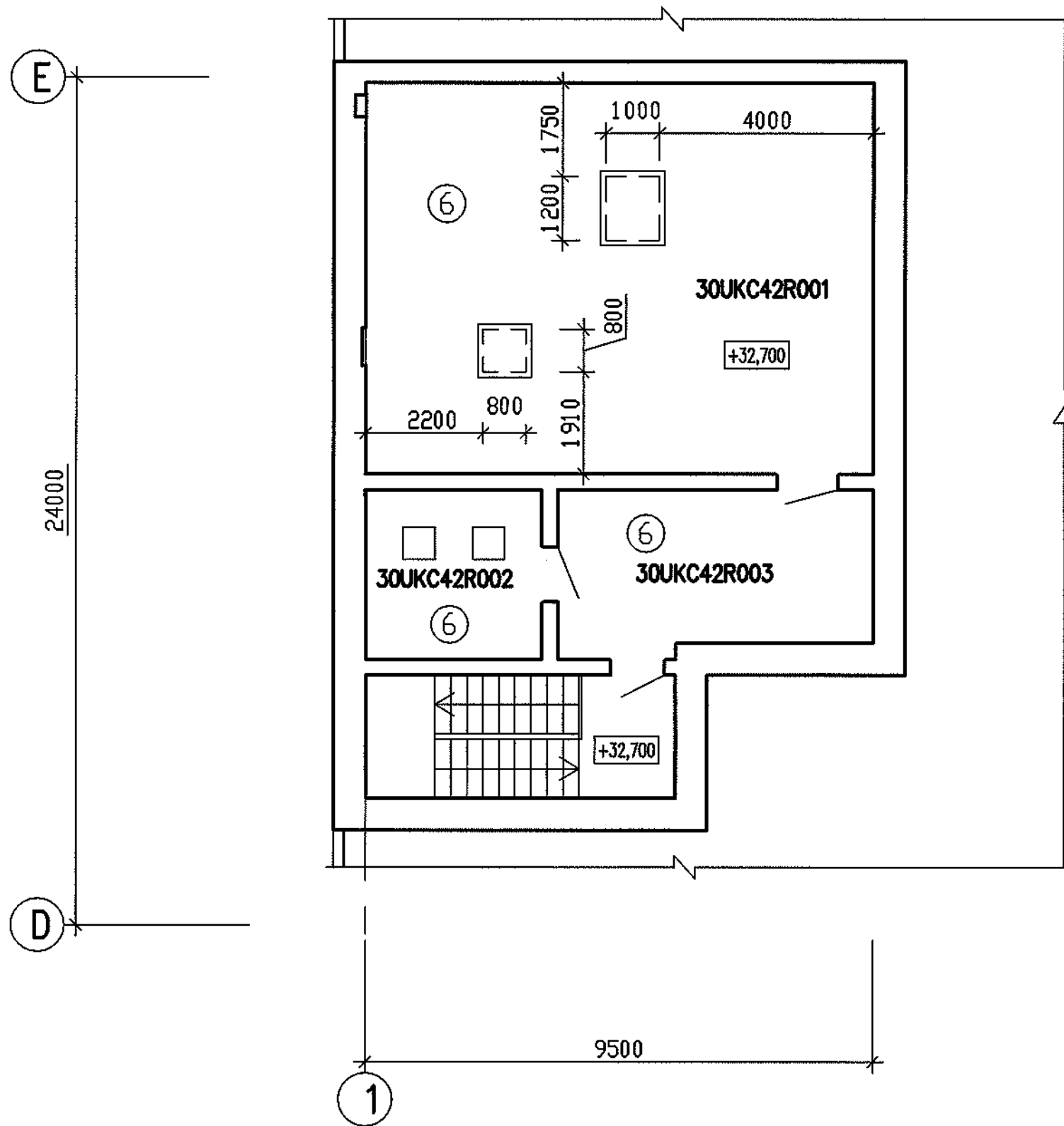


Package Number 3 14 2 8
File: R01.KK34.30UKC.0.AR.OK.WD021_002=0

R01.KK34.30UKC.0.AR.OK.WD021				АЭС "КУДАНКУЛАМ" БЛОК 3 NPP "KUDANKULAM" UNIT 3			
Изм. Кол.ч. Лист N док. Подпись Дата				30UKC. Вспомогательное реакторное здание с БУ. Полы и фундаменты для оборудования на опр.+27.600; +32.700			
Rev. pers. Sheet No. Signature Date				30UKC. Reactor Auxiliary & Main Control Room Building. Floors and foundations for the equipment at el. +27.600; +32.700			
Утвержден Approved				Voronova			
Н. контр. Inspector				Semin			
Разработ. Designed				Isakov			
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of the JSC "Atomenergoproekt"				План на отметке +27,600. Экспликация помещений Plan at elevation +27.600. Explication of compartments			
JSC "Atomenergoproekt" Moscow 2019				формат А1			

31.03.2019
84.03.19
31.03.2019
84.03.19

ПЛАН НА ОТМЕТКЕ +32,700
PLAN AT ELEVATION +32.700



ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF COMPARTMENTS

Номер помещения No of compartment	Наименование Description	Площадь Area, m ²	Категория помещения Category of compartment
	Здание UKC Building UKC		
30UKC42R001	Машинное отделение лифта Lift engine room	19,9	B4
30UKC42R002	Помещение вентиляторов системы KLE27 Room for ventilation units of KLE27 system	22,4	A
30UKC42R003	Тамбур Tambour	25,4	-

* Категория по взрывопожарной и пожарной опасности
* Explosion and fire hazard category

ЗКД-II — периодически обслуживаемые помещения "зоны контролируемого доступа"
CnAA-II — periodically attended rooms of "controlled access area"

ЭКСПЛИКАЦИЯ ПОЛОВ НА ОТМЕТКАХ +27,600 И +32,700
EXPLICATION OF FLOORS AT ELEVATIONS +27.600 AND +32.700

Номер помещения No. of room	Тип полов Type of floors	Схема пола или тип пола по серии Arrangement or type of floor as per series	Данные элементов пола (наименование, толщина, основание и др.), мм Floor components data (description, thickness, base, etc.), mm	Площадь, м ² Area, m ²
		Здание UKC Building UKC		
30UKC37R002 30UKC37R003	1		Конструкция пола смотрите чертежи марки "КМ" Пакет 3 12 2 1 For the floor structure see drawings of "KM" mark Package 3 12 2 1	88,3
30UKC37R008 30UKC37R009	2		Покрывое — смотрите п.1 на данном листе Стяжка — мелкозернистый бетон класса B30, W8 группа Б, W8 по уклону (смотрите план пола) Основание — монолитное железобетонное перекрытие смотрите п.2 на данном листе Coating — see i.1 in this sheet Levelcrete — fine concrete of B30 grade, group B, W8 as per slope (see floor plan) Base — cast-in-place reinforced concrete floor see i.2 in this sheet	178,7
30UKC37R001 30UKC37R001A 30UKC37R001B 30UKC37R001C 30UKC37R001D 30UKC37R001E 30UKC37R004 30UKC37R005 30UKC37R006 30UKC37R007 30UKC42R001 30UKC42R002 30UKC42R003	6		Покрывое — смотрите п.1 на данном листе Стяжка — мелкозернистый бетон класса B25, группа Б, W4 — 47 Основание — монолитное железобетонное перекрытие Coating — see i.1 in this sheet Levelcrete — fine concrete of B25 grade, group B, W4 — 47 Base — cast-in-place reinforced concrete floor	175,6

ВЕДОМОСТЬ РАСХОДА МАТЕРИАЛОВ
LIST OF MATERIAL CONSUMPTION

N No	Наименование Designation	Ед. изм. M. U.	Кол. Q-ty	Примечание Note
1	Мелкозернистый бетон класса B30, группы Б, W8 Fine concrete of B30 grade, group B, W8	m ³	14,3	
2	Мелкозернистый бетон класса B25, группы Б, W4 Fine concrete of B25 grade, group B, W4	m ³	8,8	
3	Гидроизоляционный состав (по типу ХУРЕХ) Waterproofing compound (by type ХУРЕХ)	m ²	175,6	

- 1 Покрывое пола смотрите отдельные чертежи спецотделки пакет 3 14 6 66. Толщина покрытия должна быть не более 3 мм.
- 2 Для типа пола "2" покрытие монолитной железобетонной плиты должно быть пропитано гидроизоляционным составом проникающего действия (по типу ХУРЕХ).
- 3 Отделка поверхностей бетонных покрытий полов — шлифование.
- 4 В помещении 30UKC42 R001 вокруг отверстий для пропуска кабелей выполнить бетонные бортики 100x100(h) мм.

1 For composition of floor coating see separate drawings of special finishing package 3 14 6 66.
Coating thickness shall be no more than 3 mm.

2 For type "2" floor, the coating of cast-in-place reinforced concrete slab shall be impregnated with a waterproofing compound with penetrating effect (by type ХУРЕХ).

3 Finishing of the surfaces of floor concrete coatings is polished.

4 Concrete skirtings 100x100(h) mm shall be made in room 30UKC42R001 around the openings for cables passing.

Package Number 3 14 2 8
File: R01.KK34.30UKC.0.AR.OK.WD021_003=0

Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия АО "Атомэнергoproject"		R01.KK34.30UKC.0.AR.OK.WD021	
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of the JSC "Atomenergoproekt"		АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 3	
Изм. Rev.	Кол. Qty.	Лист Sheet	Лист Doc.
Умбегүүл Approved	Voronova	Подпись Signature	Дата Date
Н. контр. Inspector	Semina	Подпись Signature	Дата Date
Разраб. Designed	Isakov	Подпись Signature	Дата Date
30UKC.Вспомогательное реакторное здание с БПВ. Полы и фундаменты для оборудования на отм.+27,600; +32,700 30UKC.Reactor Auxiliary & Main Control Room Building. Floors and foundations for the equipment at el. +27.600, +32.700		Стадия Phase	Лист Sheet
План на отметке +32,700. Экспликация помещений. Экспликация полов на отметках +27,600 и +32,700 Plan at elevation +32.700. Explan of compartments. Explan of floors at elevations +27.600 and +32.700		Лист 3	Лист 3
		JSC "Atomenergoproekt" Moscow 2019	

формат A1

Architectural floor plan of a building, likely a residential or institutional structure, showing various rooms and elevations. The plan includes a grid system with horizontal dimensions (1900, 19200, 21000, 57000, 21000, 15000) and vertical dimensions (24000, 3200). Rooms are labeled with codes such as 30UKC02R001, 30UKC02R016, 30UKC02R015, 30UKC02R019, 30UKC02R012, 30UKC02R022, 30UKC02R009, 30UKC02R010, 30UKC02R007, 30UKC02R008, 30UKC02R006, 30UKC02R005, 30UKC02R004, 30UKC02R003, 30UKC02R501, 30UKC02R021, 30UKC02R018A, 30UKC02R018B, 30UKC02R017A, 30UKC02R017B, 30UKC02R014B, 30UKC02R014A, 30UKC02R013A, 30UKC02R013B, 30UKC02R002, 30UKC02R001, 30UCA02R005, 30UCA02R011, 30UCA02R501, 30UCA02R006, 30UCA02R012, 30UCA02R010, 30UCA02R009, 30UCA02R008, 30UCA02R007. Elevations are marked throughout the plan, ranging from -7.935 to -8.400. A central area is labeled 'Приемная' (Reception) and 'Служба' (Service). A vertical metal stair is indicated on the right side. The plan also shows a curved boundary at the bottom and a grid system with letters A, B, C, D and numbers 1, 2, 3, 4, 5.

Р01. КК34. 30UKA. 0. AR. ОК. WD001
Смотрите рабочие чертежи пакета 3 2 2 9
See working drawings of Package 3 2 2 9

Architectural floor plan of a building section. The plan shows a vertical layout with various rooms and elevations. Key features include:

- Vertical Dimensions:**
 - Overall height: 24000
 - Section height: 10500
- Horizontal Dimensions:**
 - 1400
 - 2300
 - 3200
 - 500
 - 300
- Elevations (meters):**
 - 8,000
 - 7,100
 - 7,100
 - 6,500
 - 4,700
 - 4,525
 - 7,100
 - 4,525
 - 7,000
 - 7,000
 - 4,700
 - 4,700
 - 4,700
 - 4,650
 - 4,700
- Equipment and Labels:**
 - 30UCA02R501** (Vertical metal stair)
 - 30UCA02R501** (Vertical metal stair)
 - 30UCA05R407** (Elevation of chute top)
 - 30UCA05R408** (Elevation of chute top)
 - 30UCA02R501** (Elevation of chute top)
- Other Labels:**
 - Вертикальная металлическая лестница
 - Vertical metal stair
 - Отметка верха трапа
 - Elevation of chute top
- Grid Lines:**
 - Horizontal: D, C
 - Vertical: F, E

2 Ступени лестницы 250x190мм(в) выполнить из бетона класса В25 со шлифованной поверхностью в соответствии с требованиями КК. 1.0. AR, ТТ, WD005 для устройства наливного покрытия. Чертежи ограждения см. в комплекте КМ.

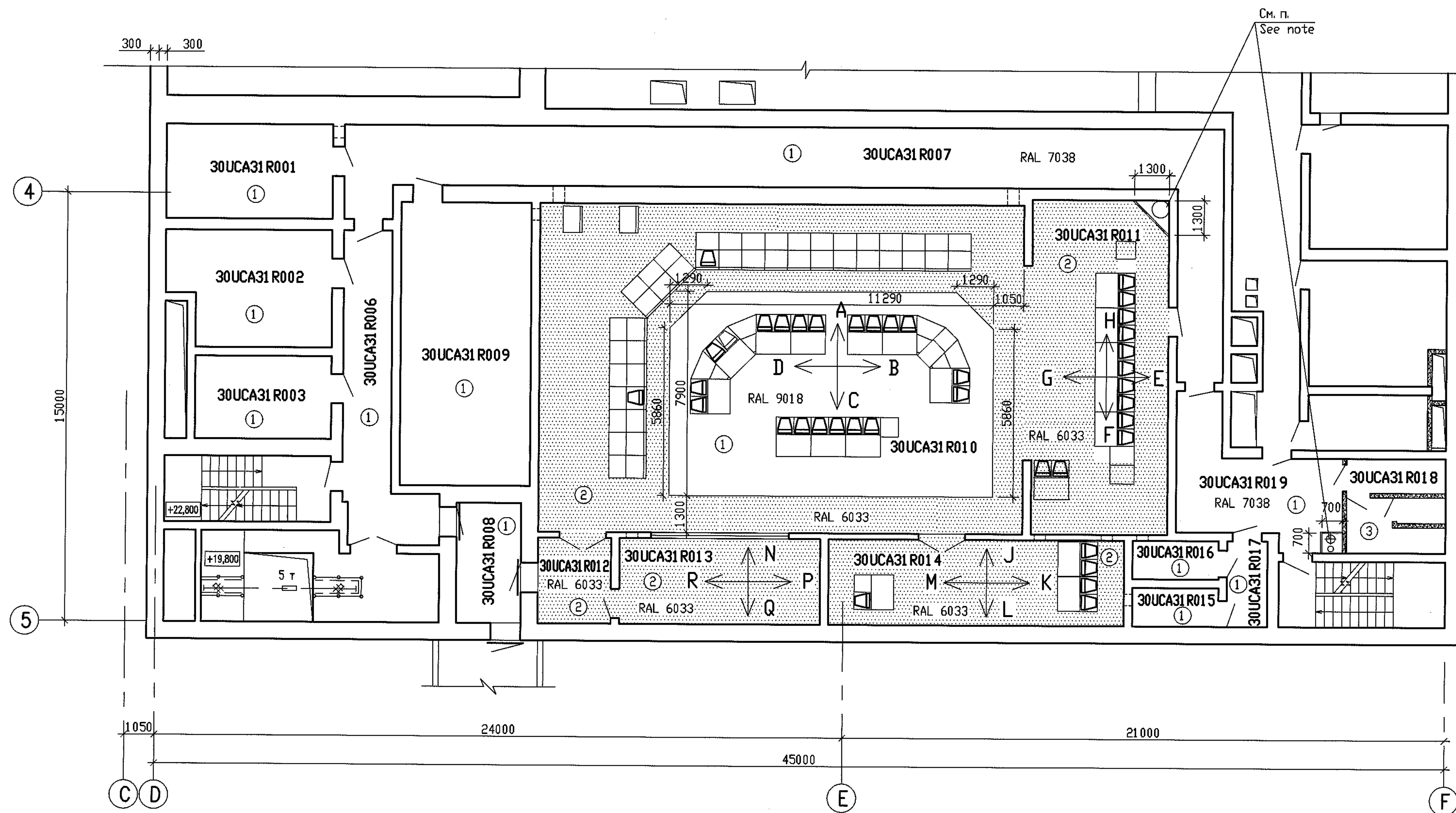
2 Stair steps 250x190 mm(h) shall be made of B25 concrete with the ground surface according to the requirements of drawing KK.1.0. AR.TT.WD005 for poured flooring arrangement. For the fencing drawings and fragments of anchoring drawings see KM set.

File: R01 KK34 30UKC 0 AR 0K WD025 002=0

						R01. KK34. 30UKC. 0. AR. PK. WD025		
						АЭС "КУДАНКУЛАМ" БЛОК НРР "КУДАНКУЛАМ" УИП 3		
Эскиз вспомогательных реакторных зданий с БЗБ блоком и фундамента для оборудования до отметки +3,600. План на отметке -8,000 Bldg. Reactor Hall (lary & Main Canal Room Building Floors and Foundations for the equipment up to elevation +3,600. Plan elevation -8,000 Планы полов на отметках -8,000 и -4,700. Отметки уровней пола Plans of the floors at elevations -8,000 and -4,700 Elevations of floors level						Смайлы Листы Листов WD 2		
Изм.	Кол. шт.	Листы	№	Подпись	Дата			
Rev.	Qty. pers.	Sheet	No.	Signature	Date			
Утверждаю Approved		Voronova		<i>Voronova</i>				
Н. контр. Inspector		Semina		<i>Semina</i>				
Разработ. Designed		Isakov		<i>Isakov</i>				
						ИС "Atomenergoproekt" Moscow 2017		

Optmat/Size A2x3

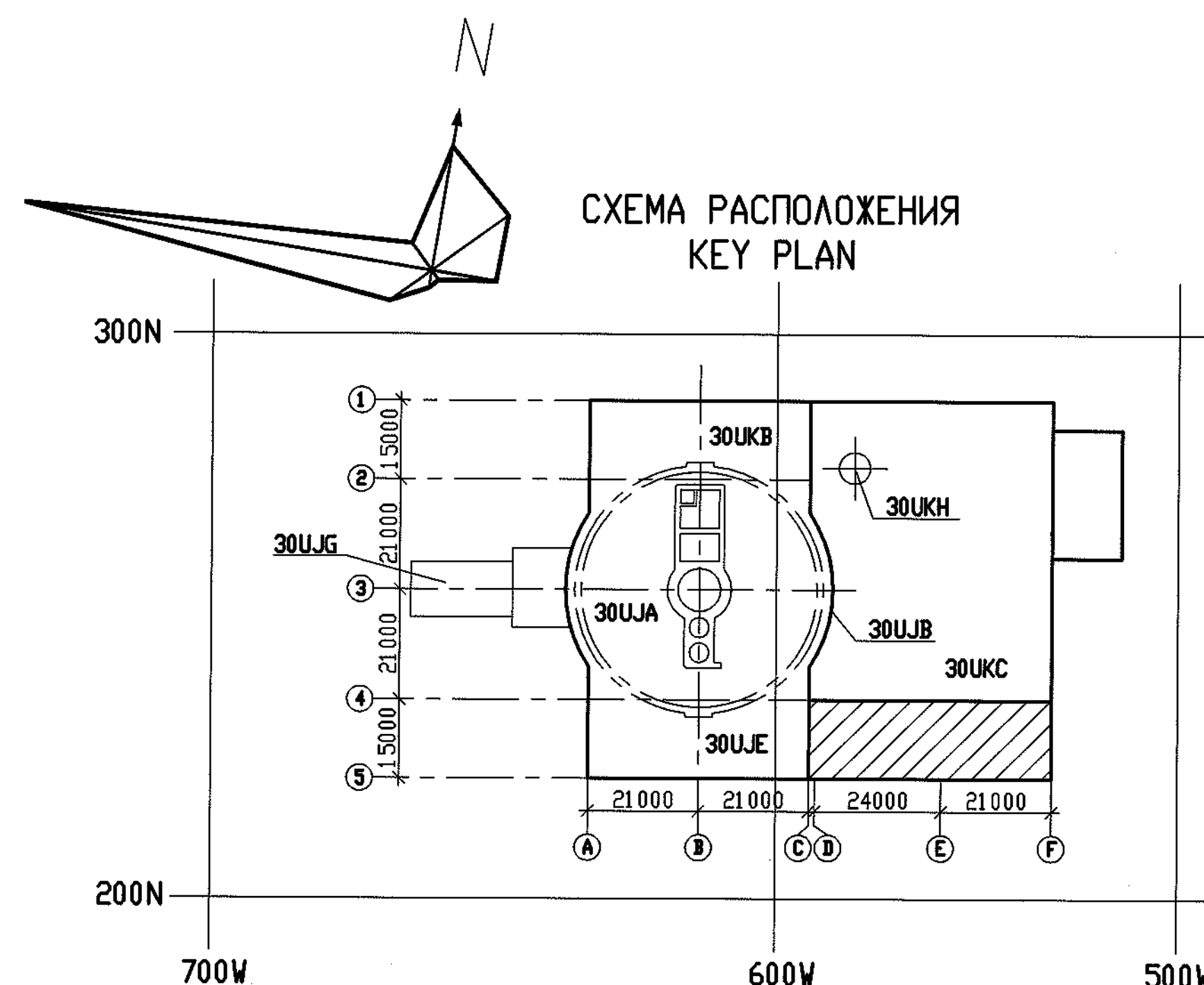
ПЛАН НА ОТМЕТКЕ +21,000
PLAN AT ELEVATION +21,000



ЭКСПЛИКАЦИЯ ПОЛОВ
EXPLICATION OF FLOORS

Номер помещения No. of room	Тип полов Type of floors	Схема пола или тип пола по серии Arrangement or type of floor as per series	Данные элементов пола (наименование, толщина, основание и др.), мм Floor components data (description, thickness, base, etc.), mm	Площадь, м ² Area, m ²
30UCA31 R001 30UCA31 R002 30UCA31 R003 30UCA31 R006 30UCA31 R007 30UCA31 R008 30UCA31 R009 30UCA31 R010 30UCA31 R015 30UCA31 R016 30UCA31 R017 30UCA31 R019	①		Покрытие - пол наливной RAL 9018 Конструкция пола - смотрите пакет 3 12 2 38 Основание - монолитная железобетонная плита Coating - poured floor RAL 9018 Floor structure - see Package 3 12 2 38 Base - cast-in-place reinforced concrete slab	334,8
30UCA31 R010 30UCA31 R011 30UCA31 R012 30UCA31 R013 30UCA31 R014	②		Покрытие - пол наливной RAL 6033 Конструкция пола - смотрите пакет 3 12 2 38 Основание - монолитная железобетонная плита Coating - poured floor RAL 6033 Floor structure - see Package 3 12 2 38 Base - cast-in-place reinforced concrete slab	214,6
30UCA31 R018	③		Покрытие - керамическая плитка RAL 7035 Конструкция пола - смотрите пакет 3 12 2 38 Основание - монолитная железобетонная плита Coating - ceramic tile RAL 7035 Floor structure - see Package 3 12 2 38 Base - cast-in-place reinforced concrete slab	11,4

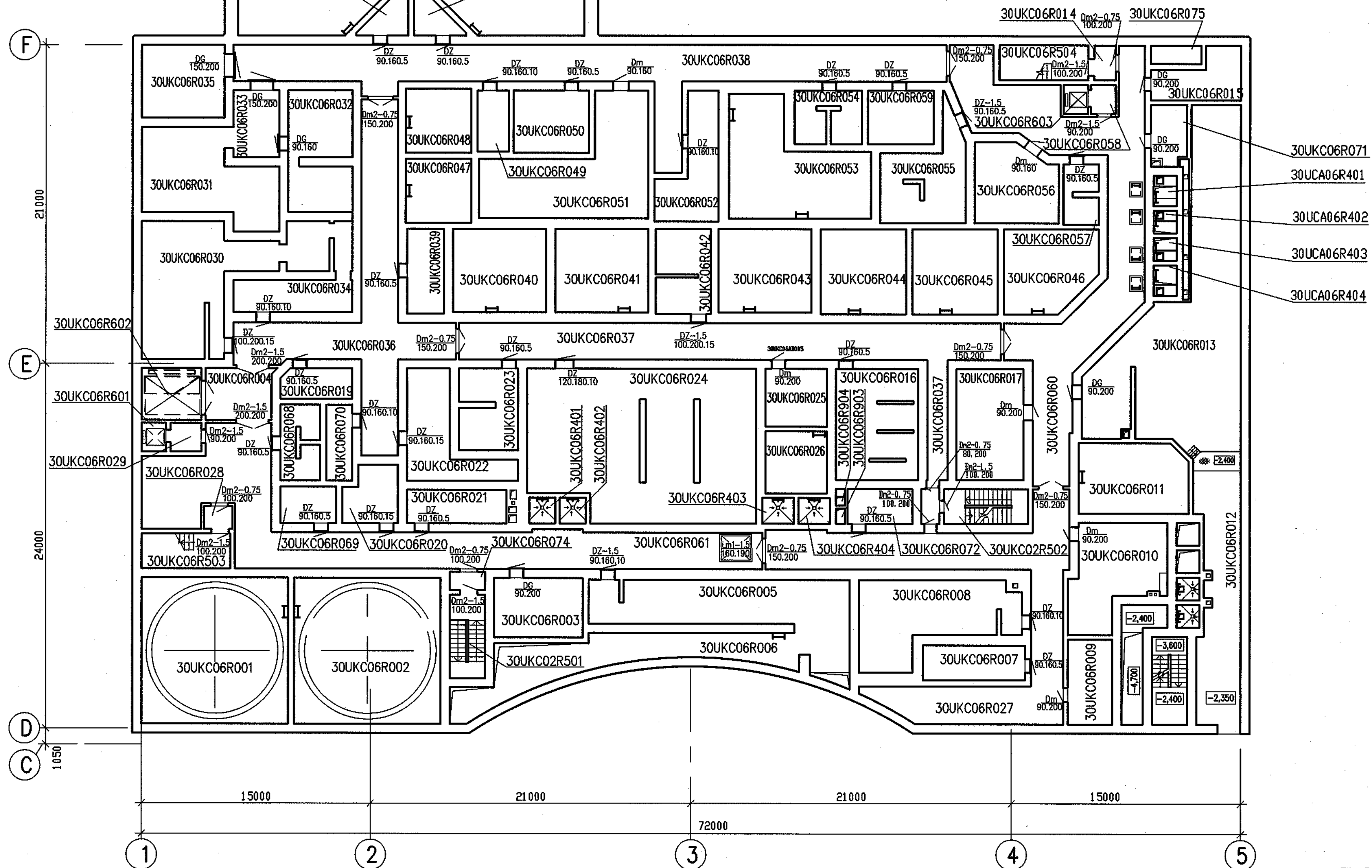
Ограждение вент. короба смотрите отдельный пакет чертежей 'KM'
For the enclosure of air duct see separate package of 'KM' drawings



Package Number 3 11 2 26
File: R01.KK34.30UKC.0.AR.OK.WD026_002=0

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							АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 3					
							30UKC. Вспомогательное реакторное здание с БЩУ. Интерьер БЩУ. 30UKC. Reactor Auxiliary & Main Control Room Building. MCR interior					
							План на отметке +21,000 Plan at elevation +21,000					
							JSC "Atomenergoproekt" Moscow 2018					
Изм.	Кол. уч.	Лист	№ док.	Подпись	Дата							
Rev.	Qty pers.	Sheet	Doc. No	Signature	Date							
Утвержден				Voronova	2020							
Н. комп. инспектор			Semina		02.07							
Разработчик			Isakov		12.06							

ПЛАН НА ОТМЕТКЕ -3,600
PLAN AT ELEVATION -3,600



Package Number 3 15 2 2
File: R01 KK34 30UKC 0 AR OK WD027_004=0

R01.KK34.30UKC.0.AR.OK.WD027

АЭС "КУДАНКУЛАМ" БЛОК 3
NPP "KUDANKULAM" UNIT 3

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"Атомэнергoproject"

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"Atomenergoproekt"

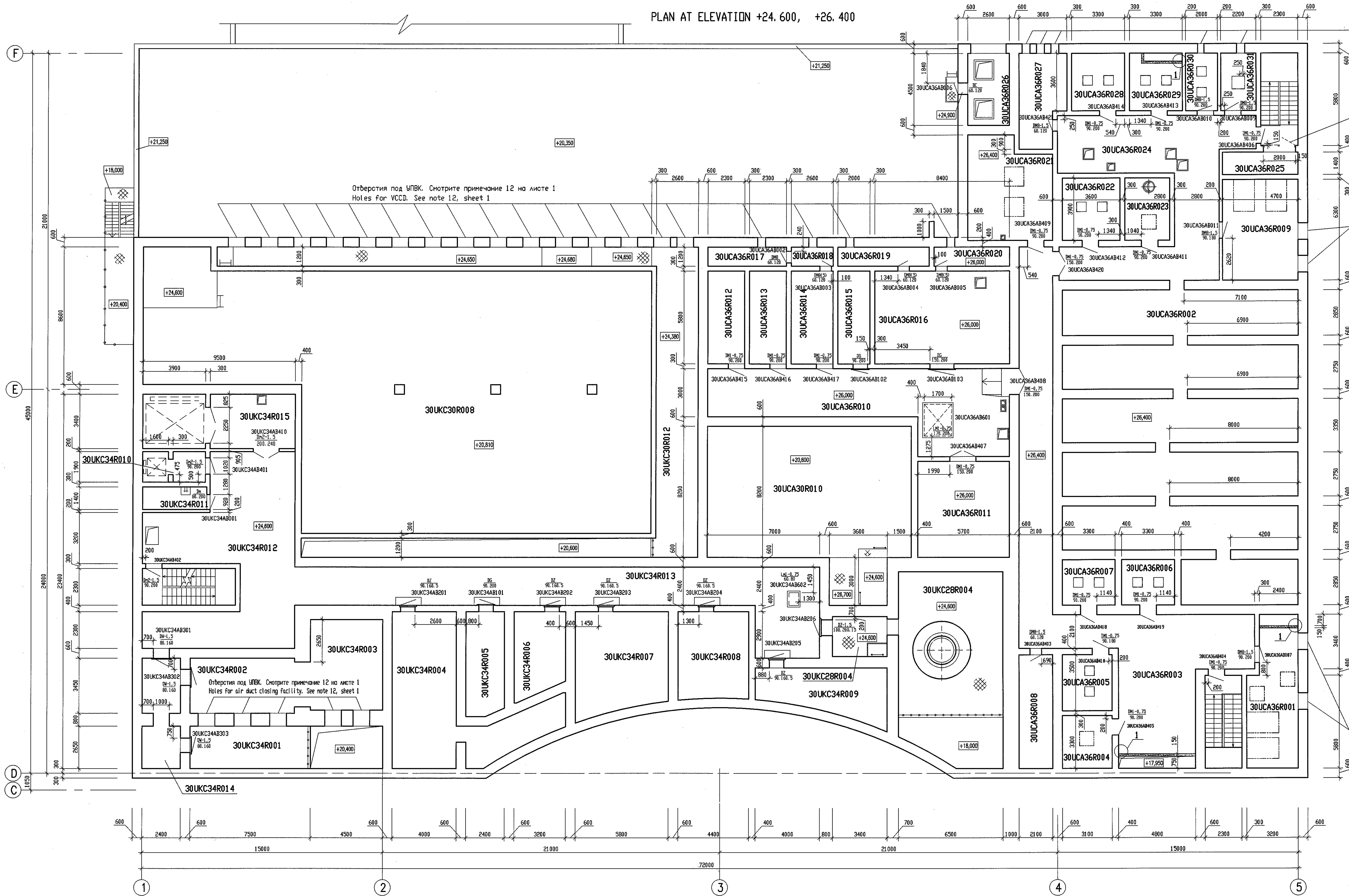
Изм.	Колуч.	Лист	N док	Погнись	Дата	30UKC. Вспомогательное реакторное здание с БПУ. Маркировочные чертежи	Стадия	Лист	Листов
Rev.	Qty.	Sheet	Doc.	Signature	Date	30UKC. Reactor Auxiliary & Main Control Room Building. Marking Drawings	Phase	Sheet	Sheets
Утвердил Approved	Voropova	28.04					WD	4	
Н. контр. Inspector	Semina	16.04				План на отметке -3,600 Plan at elevation -3,600			
Разраб. Designed	Isakov	25.04							

JSC
"Atomenergoproekt"
Moscow 2019

формат A2

Orig. arch. Nr.	Date	Replace arch. Nr.
31507	29.04.2019	

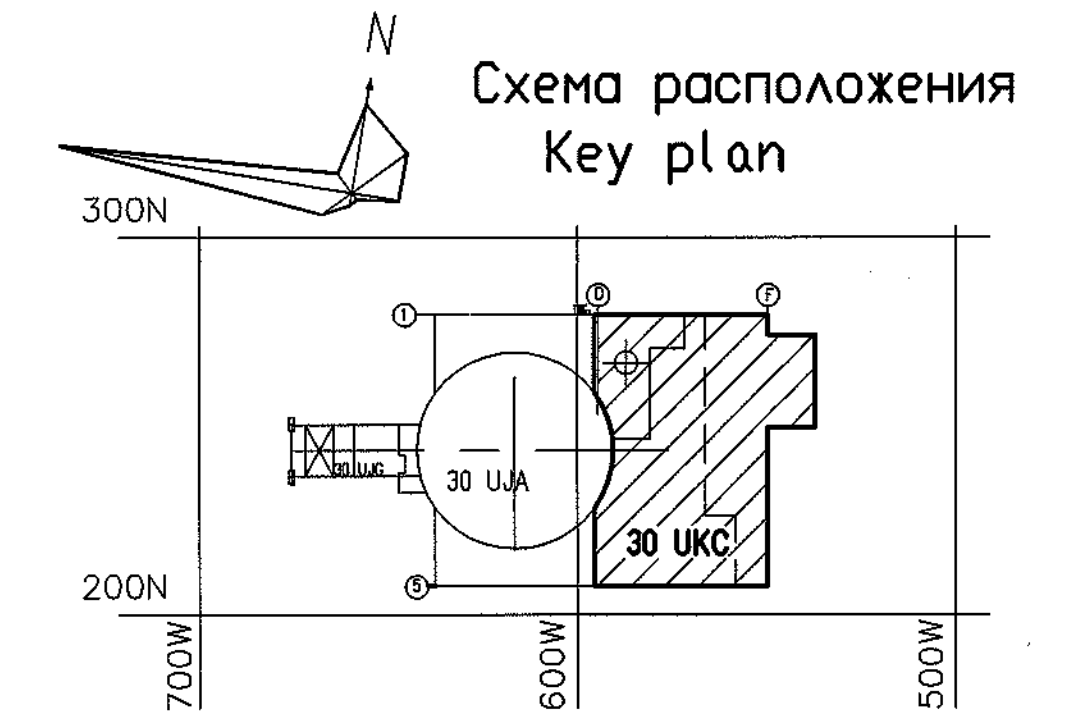
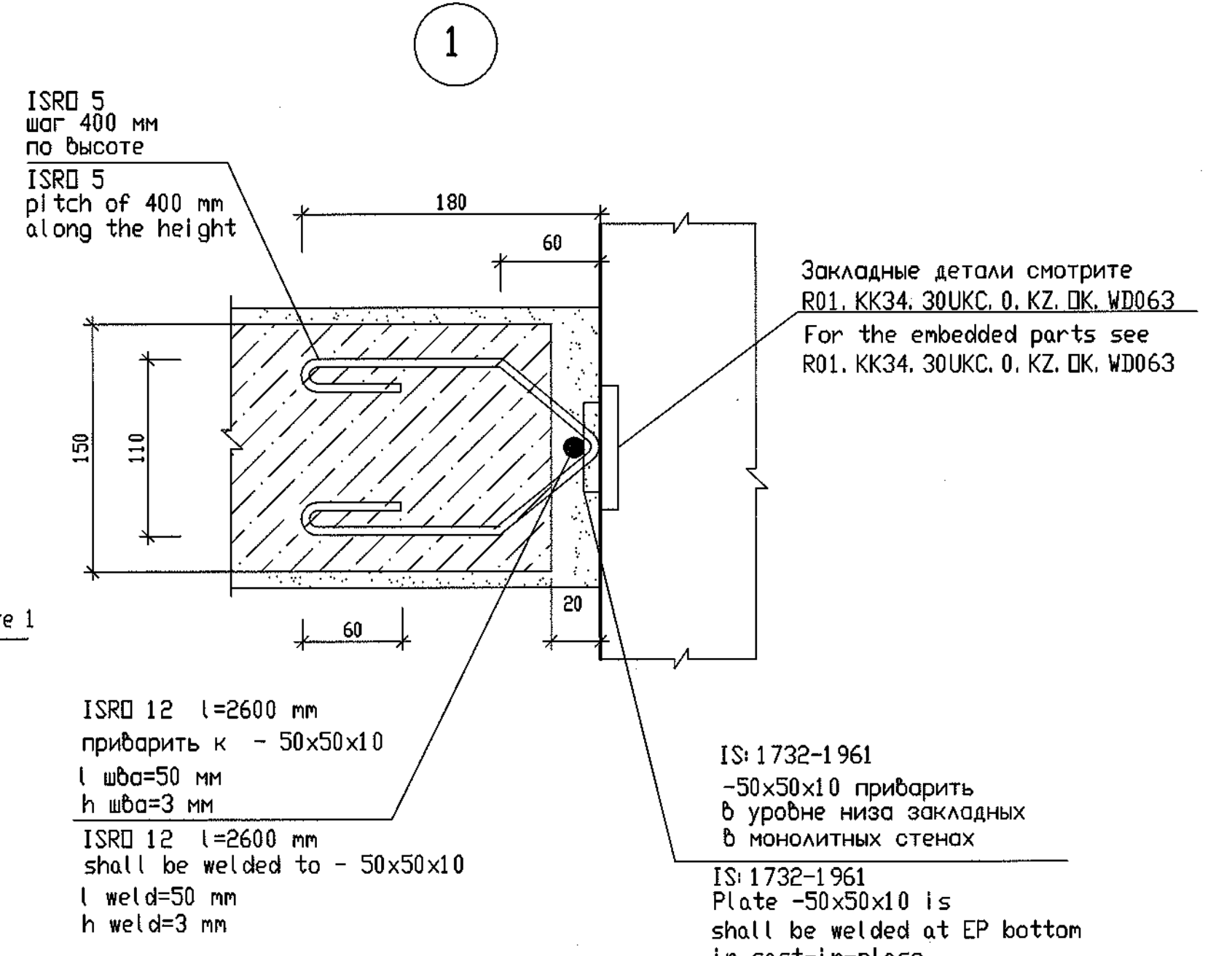
ПЛАН НА ОТМЕТКЕ +24,600; +26,400
PLAN AT ELEVATION +24.600, +26.400



Отверстия под УПВК.
Смотрите примечание 12 на листе 1
For holes for VCCD
See note 12, sheet 1

Проем 2000x2000
Обработать углом
Декоративную решетку
Смотрите в чертежах КМ
НЗ +24,600
Opening 2000x2000
Shall be angle framed.
For decorative grate
see KM drawings
Bottom +24,600

Отверстия под УПВК.
Смотрите примечание 12 на листе 1
Holes for VCCD
See note 12, sheet 1

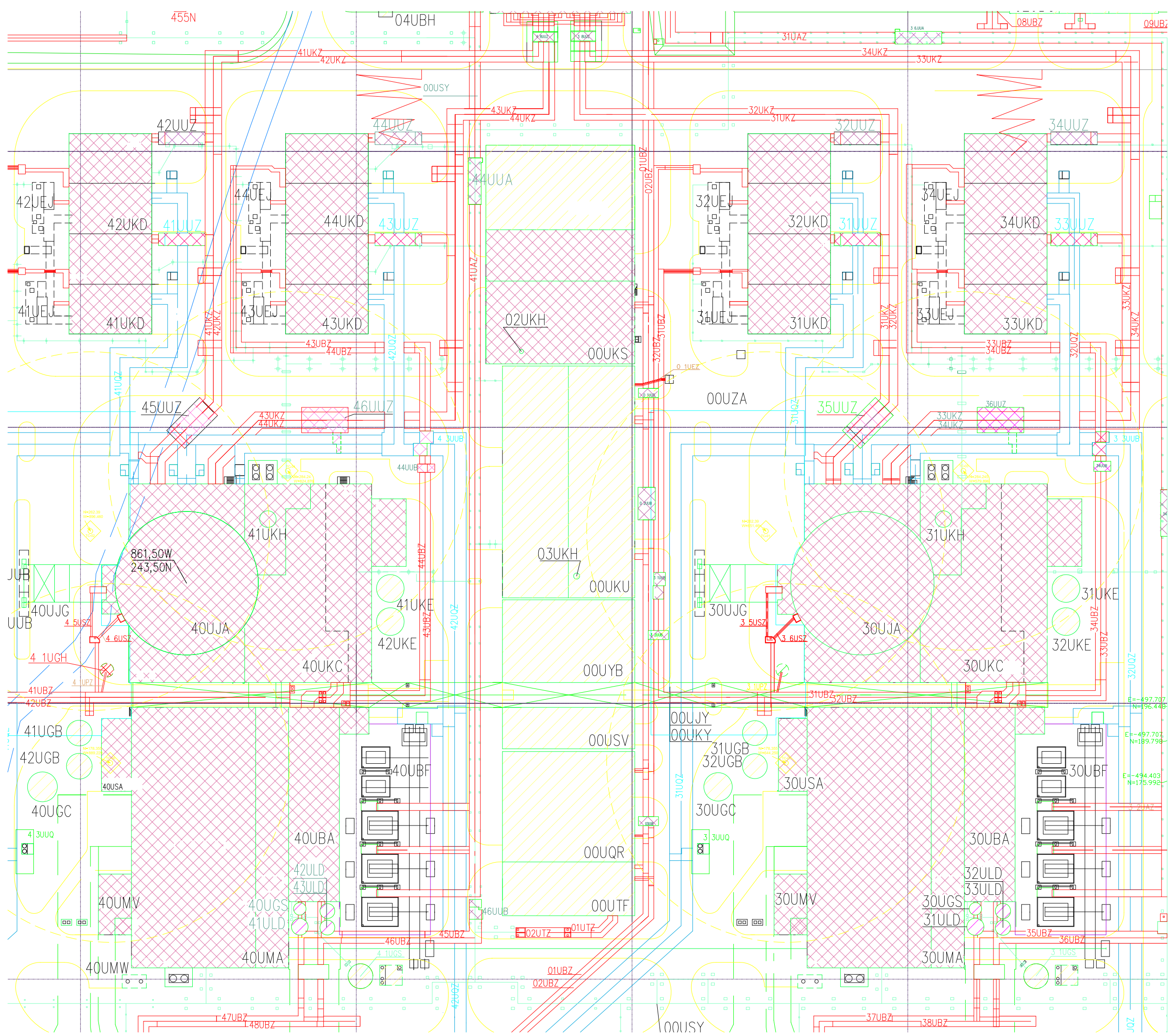


Отверстия под УПВК.
Смотрите примечание 12 на листе 1
For holes for air duct closing facility
See note 12, sheet 1

Package Number 3 10 2 47
File: R01.KK34.30UKC.0.A.R.OK.WD020_002=0

R01.KK34.30UKC.0.A.R.OK.WD020									
АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 3									
Изм.	Кол. у.	Лист	№	год	Подпись	Дата	Содержание	Лист	Листов
Rev.	Qty	Sheet	No	Year	Signature	Date	Content	Sheet	Sheets
Утвердил							30UKC Reactor Auxiliary & Main Control Room Building Architectural layout drawings at elevations +18,000, +20,400, +21,000, +24,600, Plan at elevations +24,600, +26,400	WD	2
Н. контр.							План на отметках +24,600; +26,400. Углы 1		
Inspector							Plan at elevations +24,600, +26,400. Detail 1		
Пасп.б.									
Designed									

Одобр. арх. № 27.2.3.5
Date 13.09.2018
Выпущен с 13.09.2018



ПЛАН НА ОТМЕТКЕ +5,400 В ОСЯХ 4-5
PLAN AT ELEVATION +5,400 IN AXES 4-5

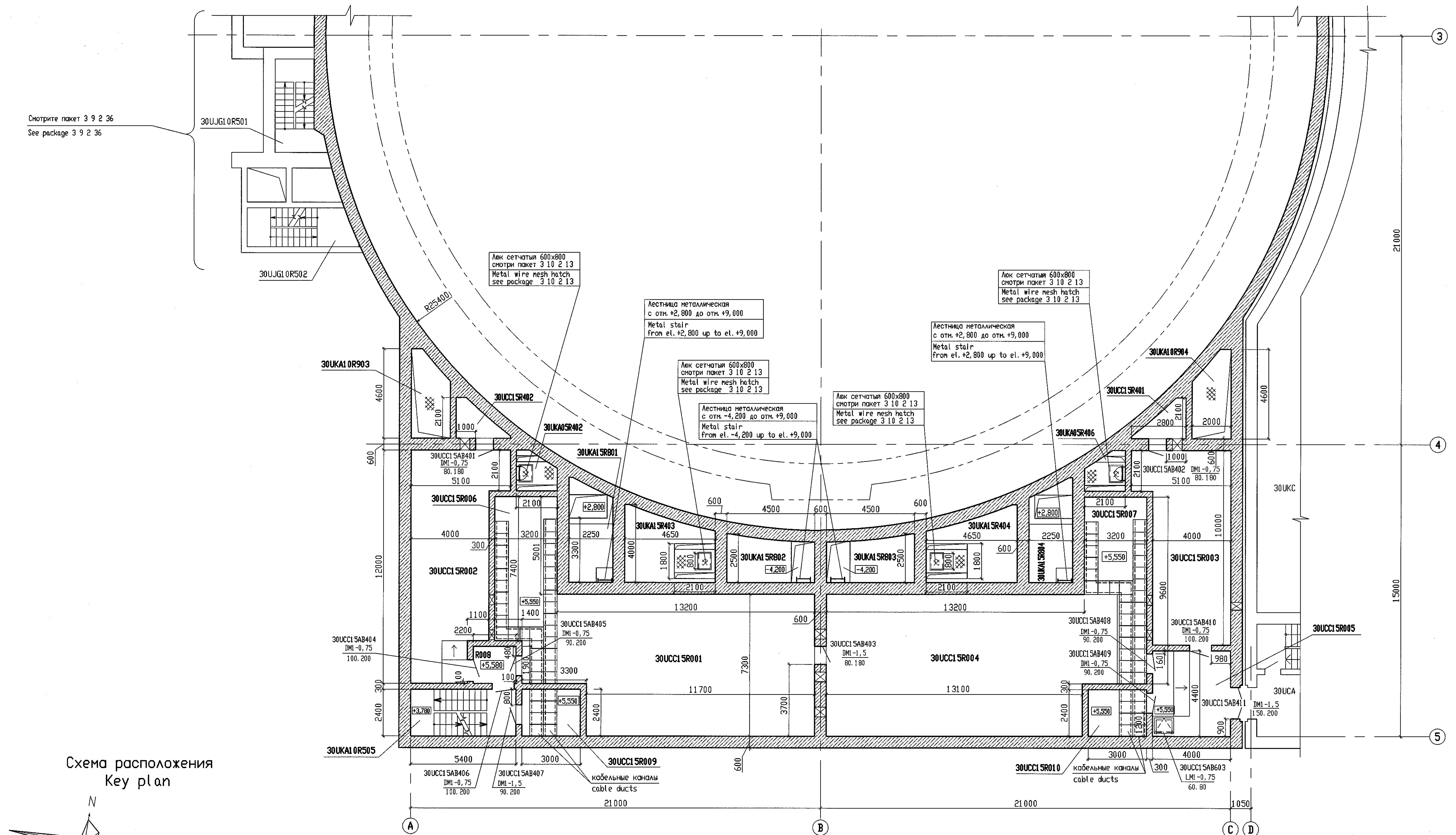
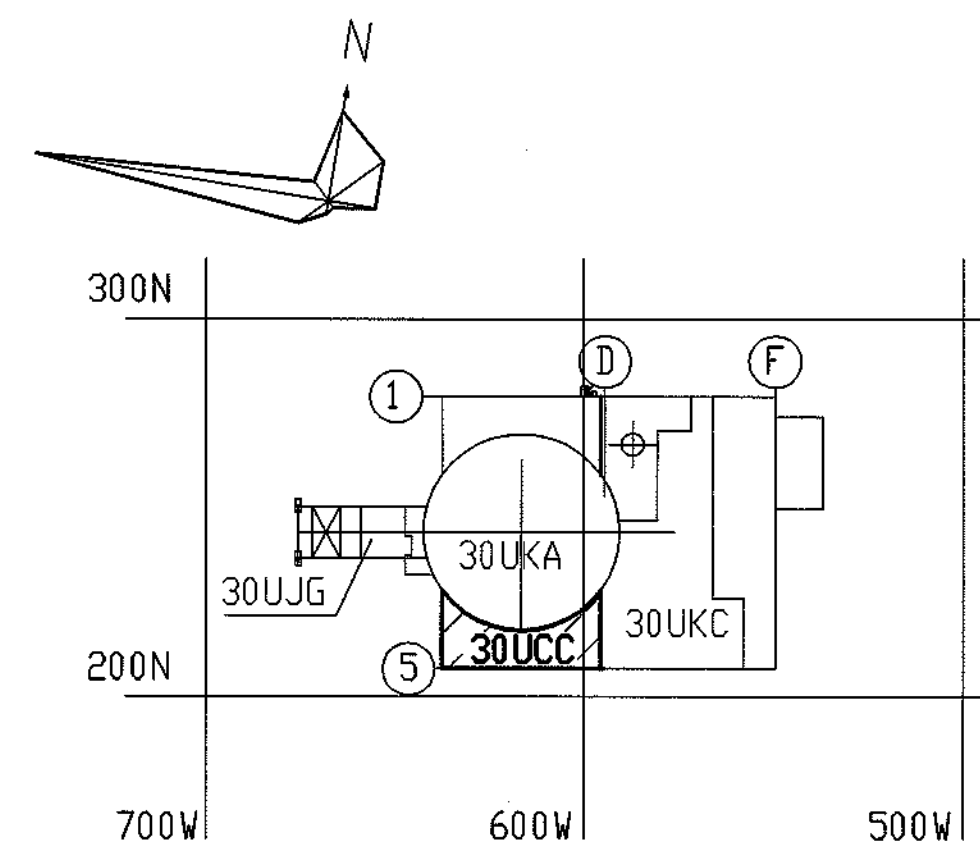


Схема расположения
Key plan



1 For arrangement of cable duct floor slabs see working drawings of floors, package 3 9 2 33.

Package Number 3 6 2 74
File: R01 KK34 30UCC 0 AR OK WD001_002=0

R01, KK34, 30UCC, 0, AR, DK, WD001
АЭС "КУДАНКУЛАМ" БЛОК 3

Данный чертеж
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организациям и лицам
без согласия АО
"Атомэнергoproject"

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30UJAC(UCC). Архитектурно-планировочные чертежи на отм. +5,400; +9,000 в осях 4-5	Стр.
План на отметке +5,400	Ph
30UJAC(UCC). Archtitectural layout drawings at el. +5,400; +9,000 in grid lines 4-5.	
Plan at elevation +5,400	

План на отметке +5,400 в осях 4-5	
Plan at elevation +5,400 in axes 4-5	

JSC
"Atomenergoproekt"
Moscow 2017

Format A1

ПЛАН НА ОТМЕТКЕ +9,000 В ОСЯХ 4-5
PLAN AT ELEVATION +9,000 IN AXES 4-5

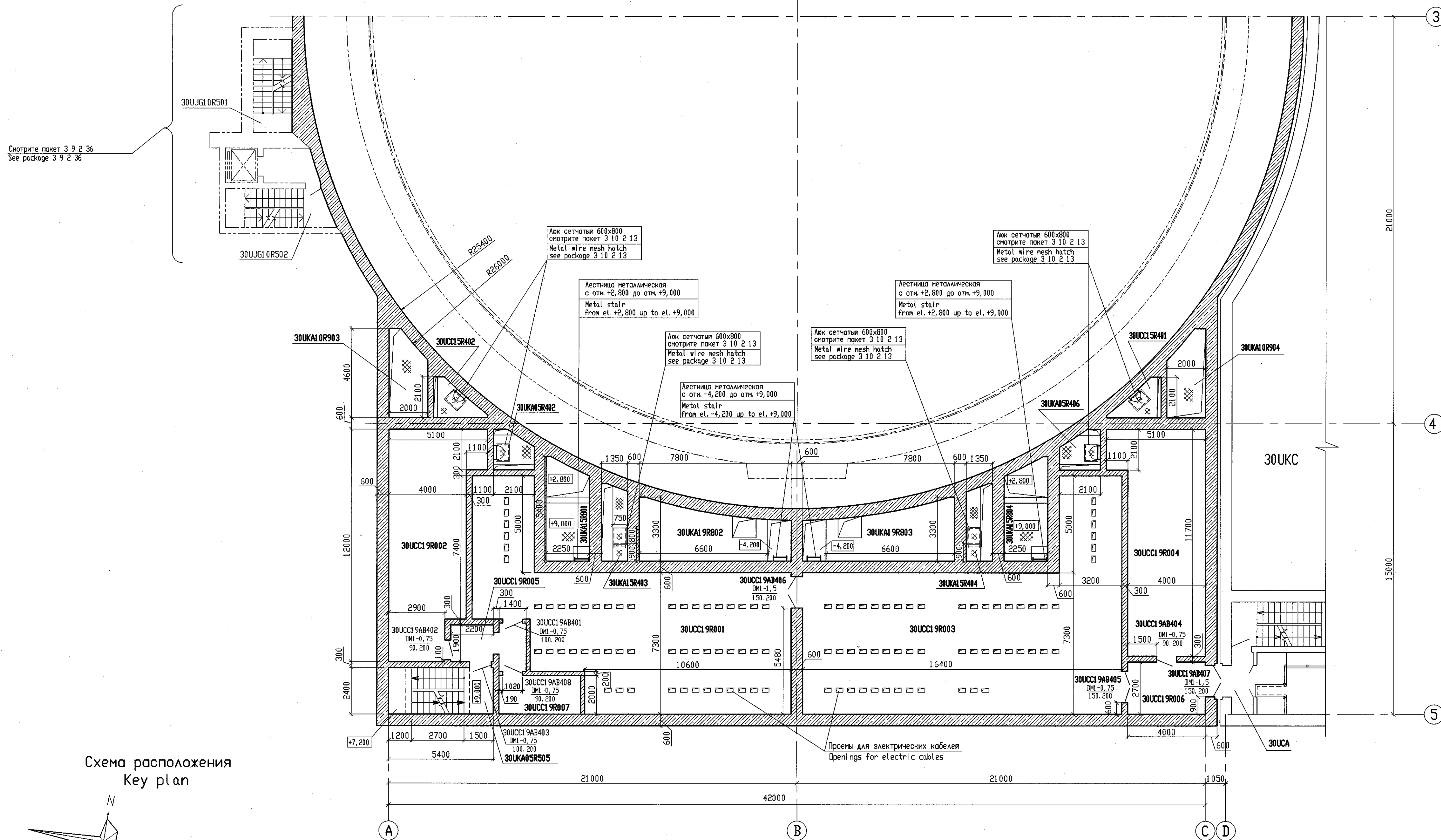
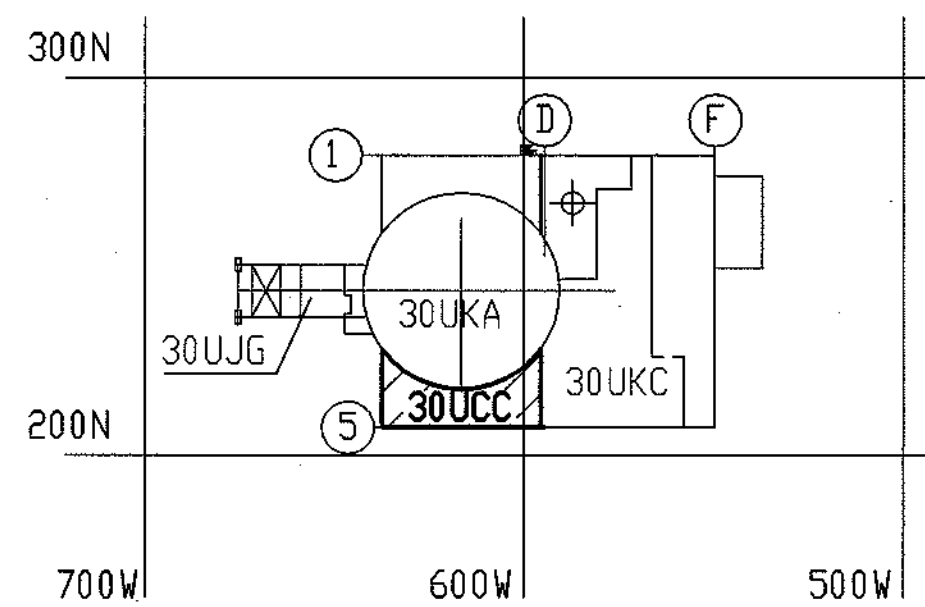
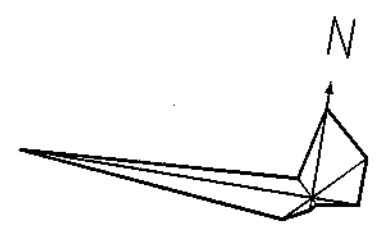


Схема расположения
Key plan



Package Number 3 6 2 74
File: R01 KK34 30UCC 0 AR DK WD002_002=0

R01. KK34. 30UCC. 0. AR. DK. WD002

AЭС "КУДАНКУЛАМ" БЛОК 3
NPP "KUDANKULAM" UNIT 3

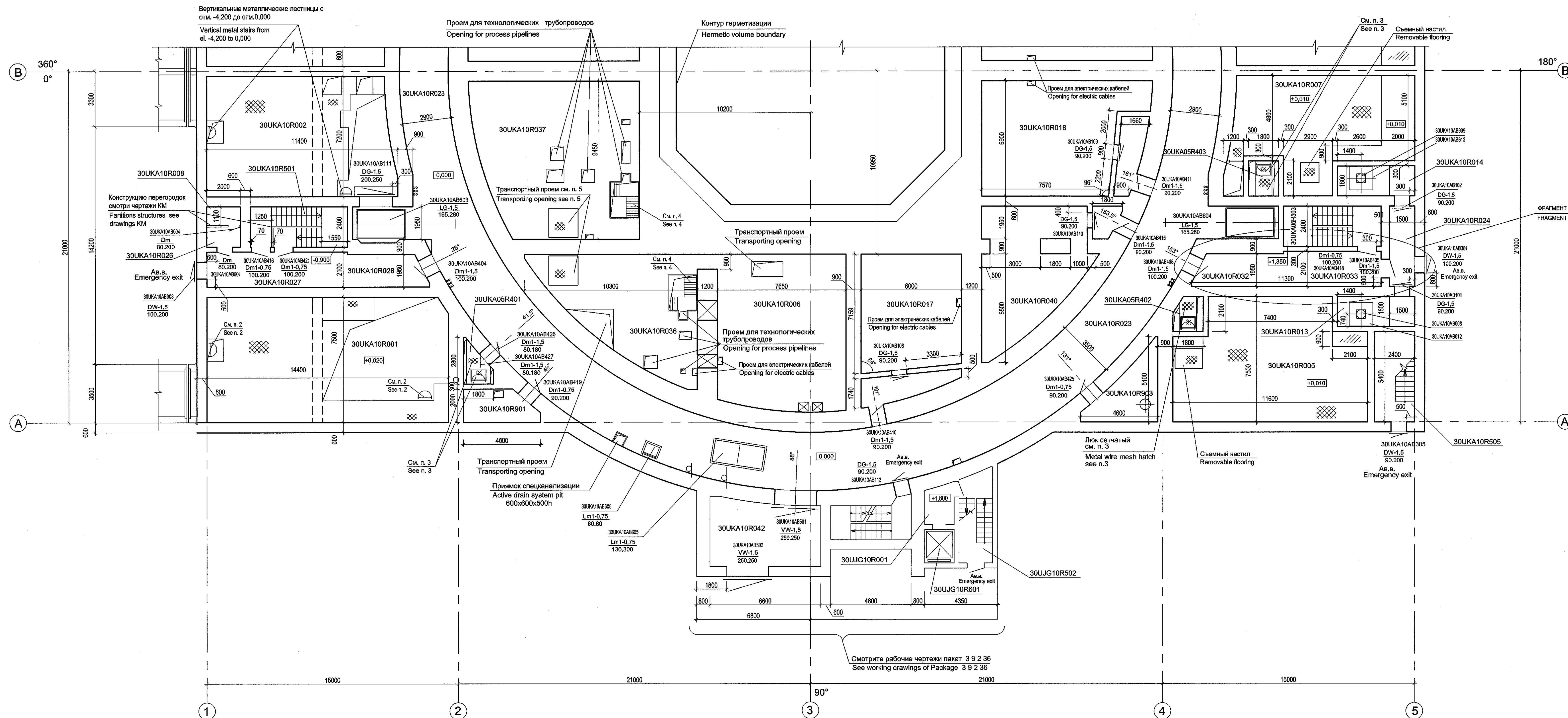
УА(УСС). Архитектурно-планировочные техн на отм. +5,400; +9,000 в осях 4-5. план на отметке +9,000	Стадия	Лист	Лист
	Phase	Sheet	Sheet

UJAK(UCC). Architectural layout drawings el. +5,400; +9,000 in grid lines 4-5. on at elevation +9,000	Phase	Sheet	Sheet
	WD	2	

plan at elevation +9,000 in axes 4-5

Format A1

ПЛАН НА ОТМЕТКЕ 0,000 В ОСЯХ А-В
PLAN AT ELEVATION 0,000 IN AXES A-B



- 1 Во время монтажа или замены оборудования в помещении: ЗОУКАИ0 R003, доплатить предусмотренные мероприятия по блокировке одноименного строящегося д/бл и люка АВ601.
- 2 Металлические лестницы с отст. -4,200 до отст.0,000 смотрите чертежи КМ, Пакет 3 4 2 15.
- 3 Лок сетчатый и металлические лестницы смотрите чертежи R01.КК34.30.ЮА.0.К.КМ.0KWD15

Пакет 3 6 2 49.

- 4 Металлические лестницы с отст. -4,200 до отст.0,000 смотрите чертежи КМ, Пакет 3 4 2 11.
- 5 Транспортный проем после монтажа оборудования перекрыть съёмным металлическим настилом.

- 1 Measures on interlock of simultaneous opening of doors AB112 and hatch AB601 shall be provided during erection and replacement of equipment in compartment 30JUKA10 R003.
- 2 Metal stairs from el.-4,200 to 0,000 see KM drawings, Package Number 3 4 2 15.
- 3 Metal wire mesh hatch and metal landings see drawings R01.KK34.30JUA.0.KM.OK.WD015, Package Number 3 6 2 49.
- 4 Metal stairs from el.-4,200 to 0,000 see drawings KM Package Number 3 4 2 11.
- 5 Transporting opening after installation of equipment should be covered with the removable metal decking.

ФРАГМЕНТ ПЛАНА НА ОТМ. +2,800 В ОСЯХ 4-5
FRAGMENT OF PLAN AT ELEVATION +2,800 IN AXES 4-5

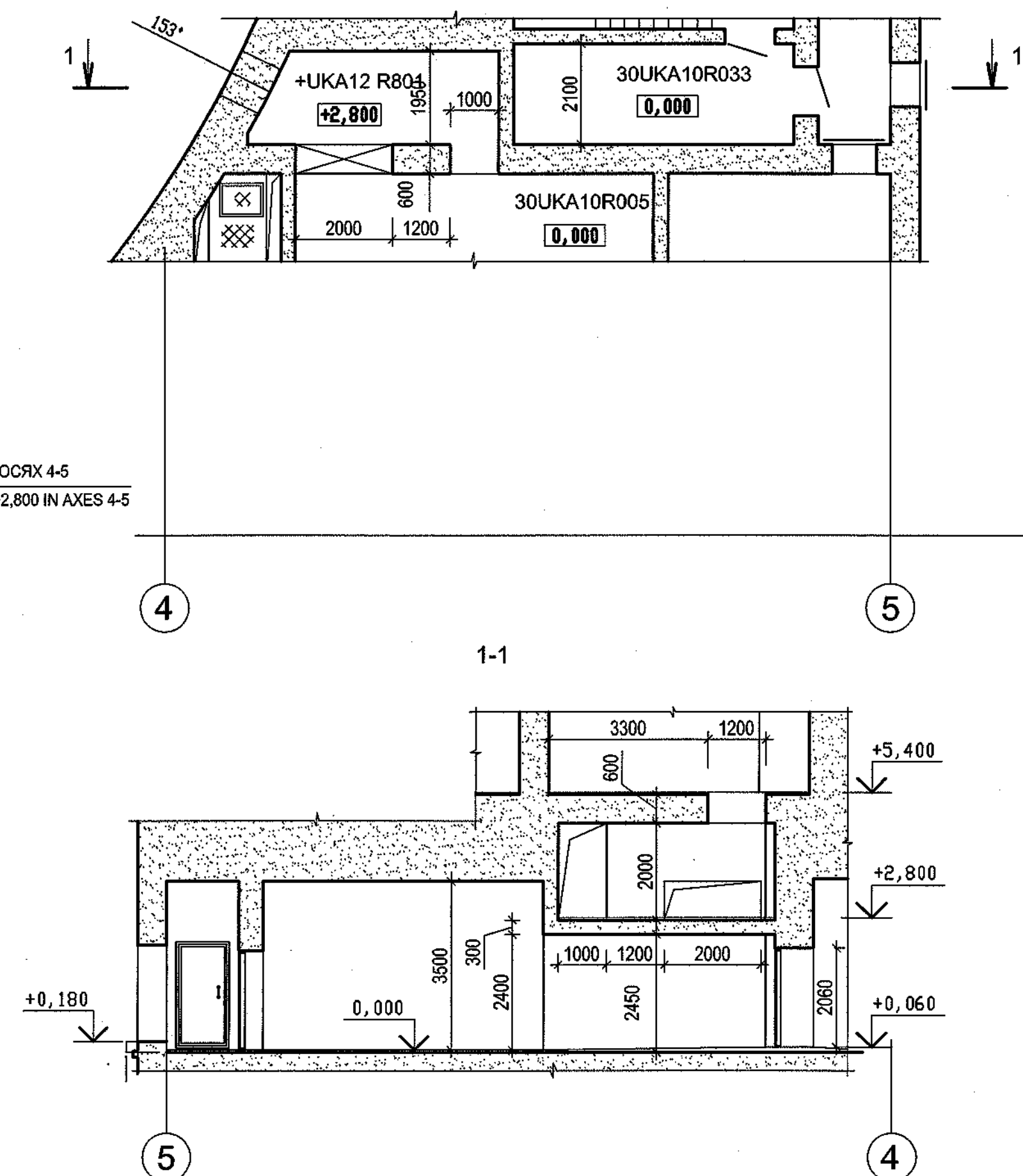
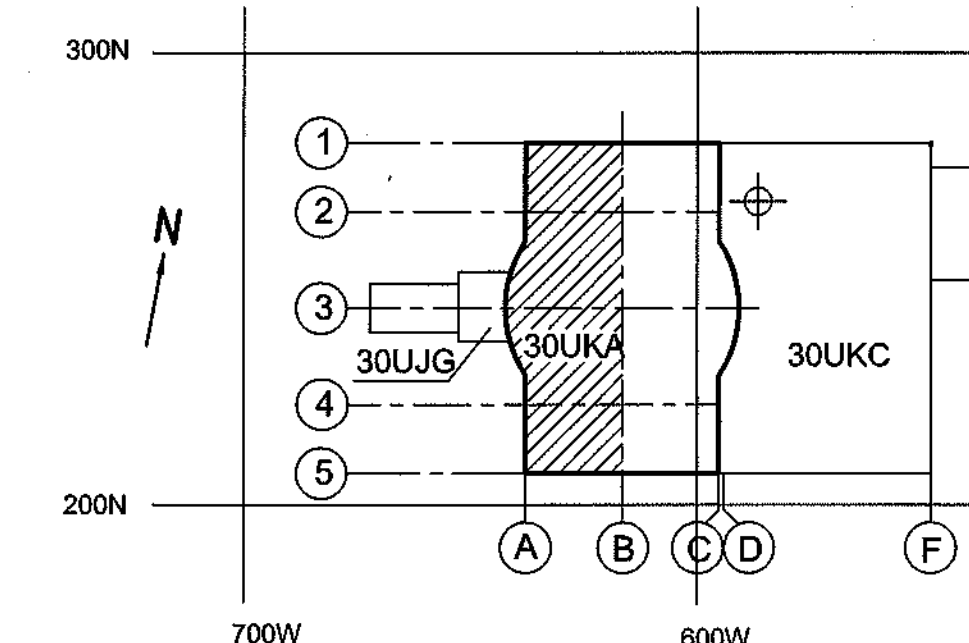


СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



Package Number 3 3 2 6
File: R01 KK34 30 UKA 0 AR OK WD003_002=0

R01.KK34.30UKA.0.AR.OK.WD003

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						R01.KK34.30UKA.0
						AЭС "КУДАНКУ NPP "KUDANKU"
Изм.	N	Лист	N	док.	Подпись	Дата
						30UA(UKA). Реакторное здание. Архитектурно-планировочные чертежи на стм. 0,000
Rev.	N	пат.	Sheet	Doc. No	Signature	Date
						30UA(UKA). Reactor building. Architectural layout drawings at el. 0,000
Утверждающий	Vorontova					
Н. контр.	<i>Semina</i>					
Inspector	Semina					
Разраб.	Исученко					
	План на отметке 0,00 в осях А-А					
	Plan at elevation 0,000 in axes A-A					

"АТОМЕРГОПРОЕКТ" БЛОК "ATOMERGOPROEKT" UNIT			3
Стадия	Лист	Листов	
Phase	Sheet	Sheets	
WD	2		
 JSC "Atomenergoproekt" Moscow 2016			

Format A2x3

ПЛАН ПОЛОВ НА ОТМЕТКЕ -7,200 В ОСЯХ А-В
PLAN OF FLOORS AT ELEVATION -7,200 IN AXES A-B

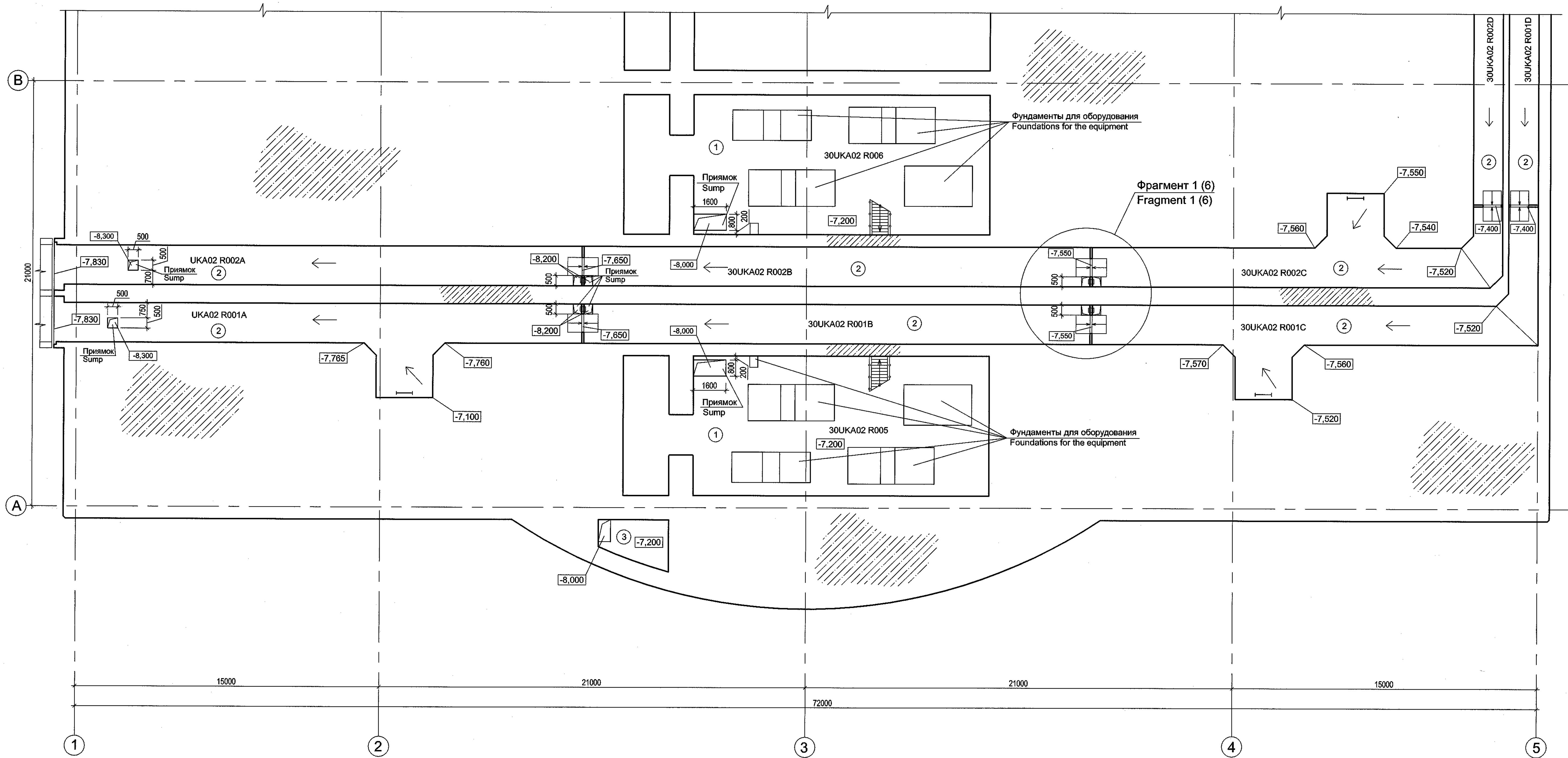
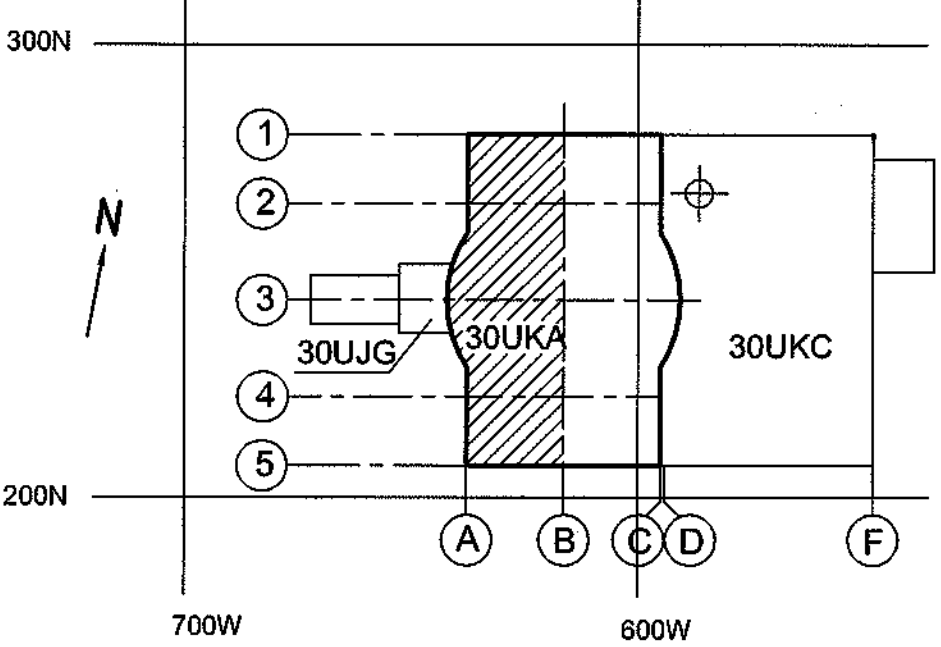


СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



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						R01.KK34.30UKA.0.AR.OK.WD002					
						АЭС "КУДАНКУЛАМ" БЛОК 3 NPP "KUDANKULAM" UNIT 3					
Изм.	Н.уч.	Лист	Н.док.	Подпись	Дата	30UKA(UKA). Реакторное здание. Полы и фундаменты для оборудования до отметки 0,000			Стация	Лист	Листов
Rev.	N pat.	Sheet	Doc No	Signature	Date	30UKA(UKA).Reactor building. Floors and foundations for the equipment upto elevation 0,000			Phase	Sheet	Sheets
Утвердил Approved	Voronova <i>[Signature]</i>					30UKA(UKA).Reactor building. Floors and foundations for the equipment upto elevation 0,000			WD	2	
Н. контр. Inspector	Semina <i>6-072</i>					План полов на отметке -7,200 в осях А-В			 JSC "Atomenergoproekt" Moscow 2016		
Разраб. Designed	Ivchenko <i>UB1</i> 02.12.					Plan of floors at elevation -7,200 in axes A-B					

ПЛАН ПОЛОВ НА ОТМЕТКЕ -4,200 В ОСЯХ А-В
PLAN OF FLOORS AT ELEVATION -4,200 IN AXES A-B

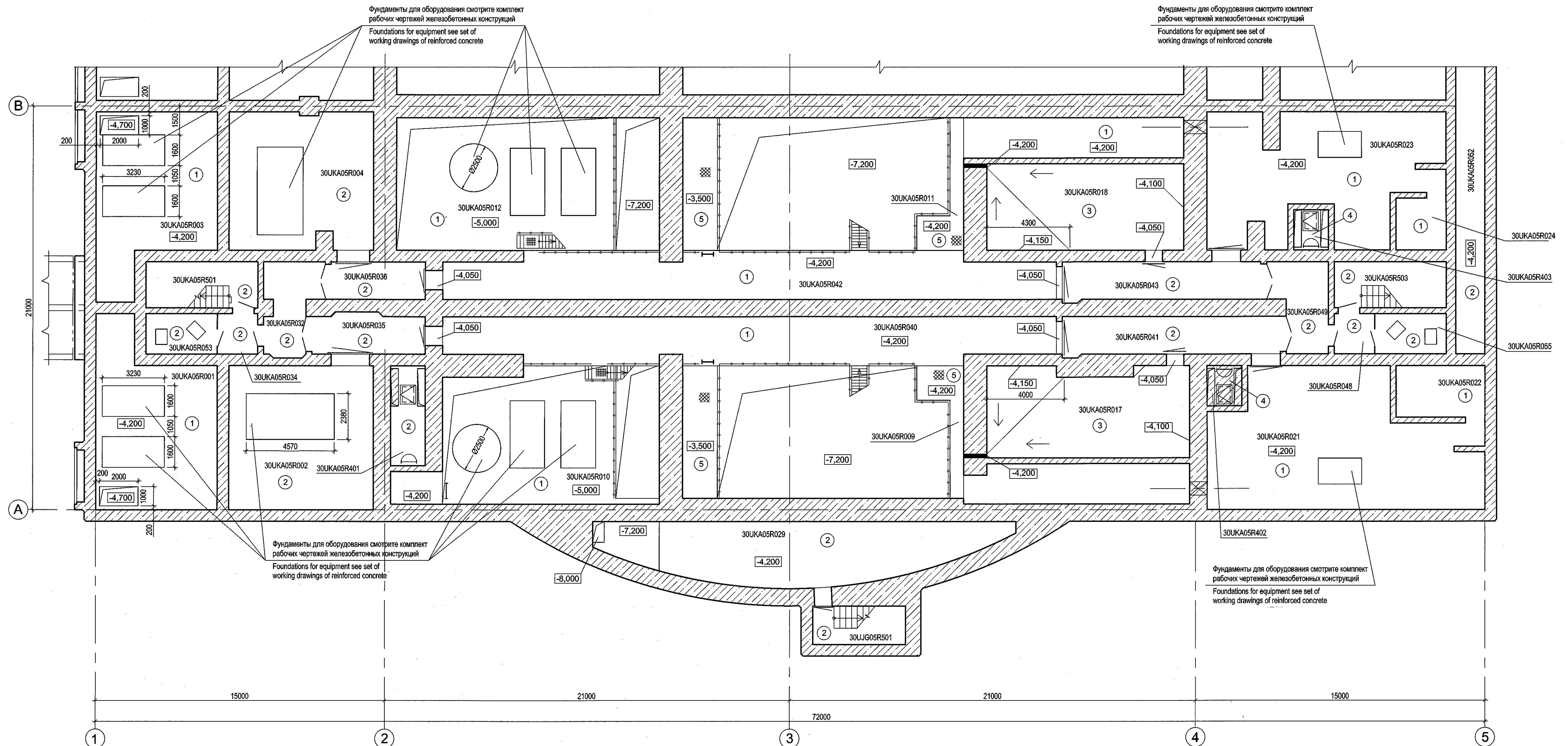
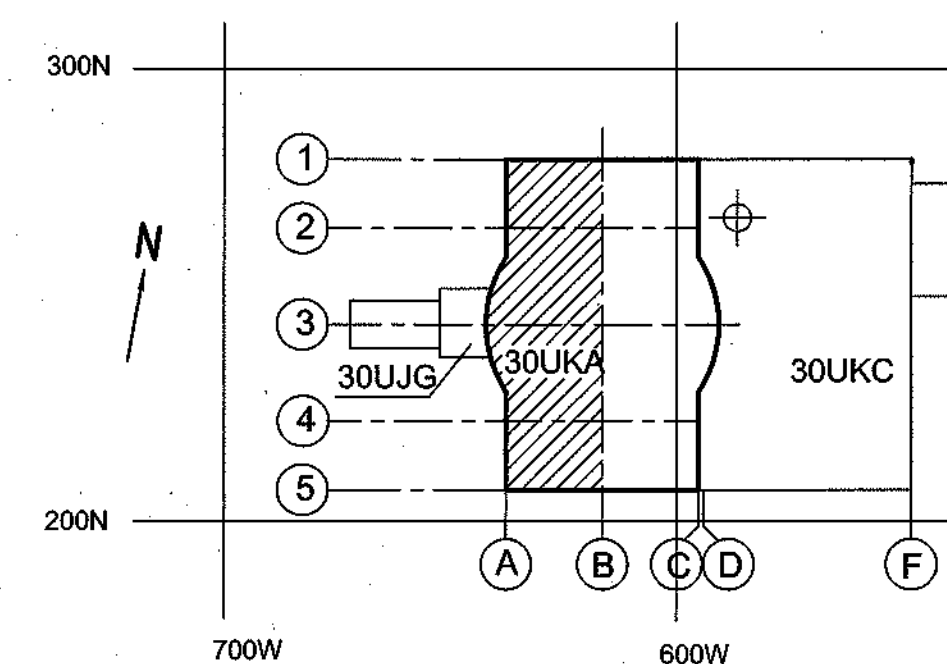


СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



Package Number 3 4 2 10
File: R01 KK34 30UKA 0 AR OK WD002 007=0

R01.KK34.30UKA.0.AR.OK.WD002	
АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT	3

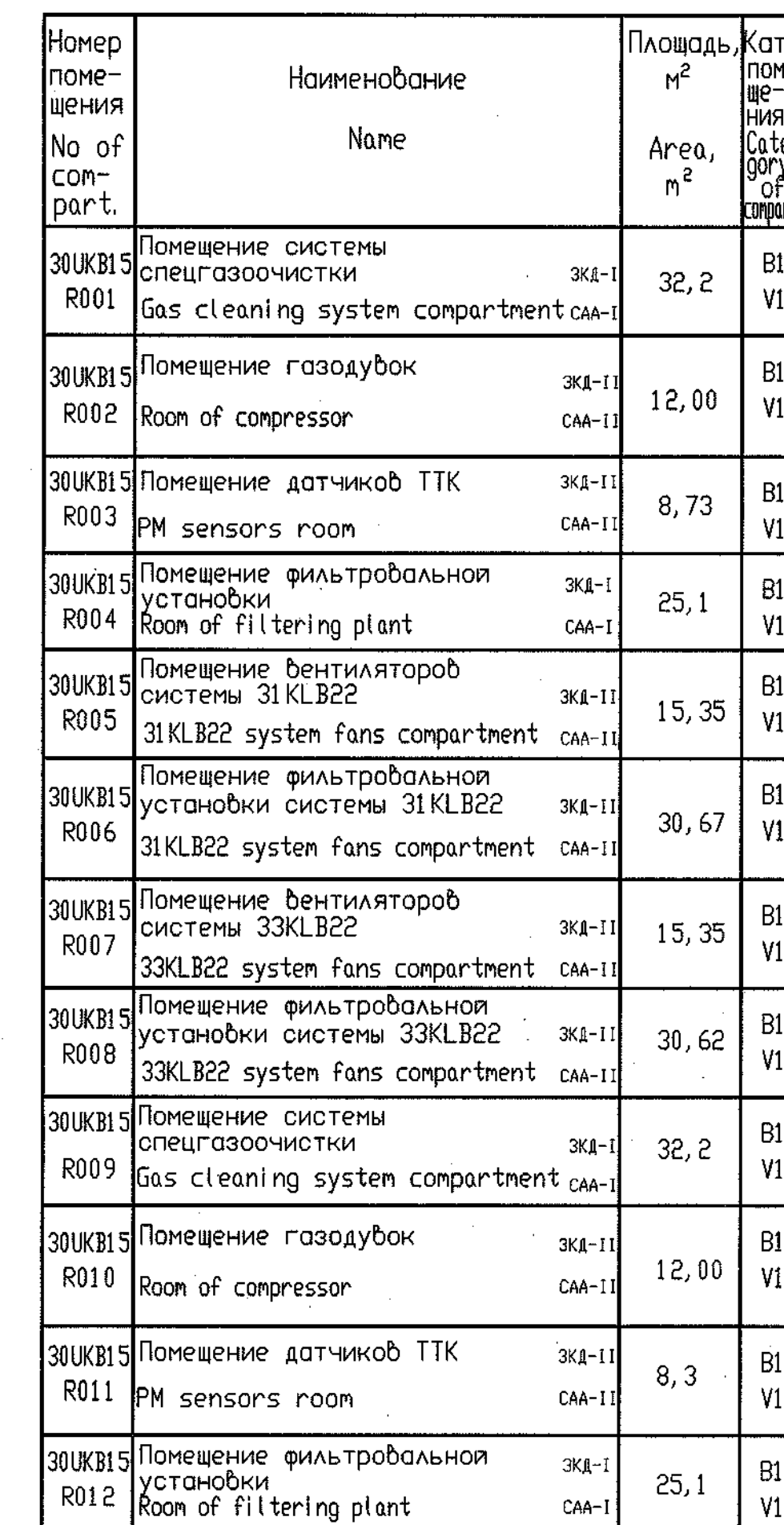
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или передаче другим
организациям и лицам
без согласия
АО "Атомэнергoproject"

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JSC "Atomenergoproekt"

						R01.KK34.30UKA.0.AR.OK.WD0002					
						АЭС "КУДАНКУЛАМ" БЛОК 3 NPP "KUDANKULAM" UNIT 3					
Изм.	Н уч.	Лист	Н док.	Подпись	Дата	30UKA (UKA). Реакторное здание. Полы и фундаменты для оборудования до отметки 0,000	Стадия	Лист	Листов		
Rev.	N pat.	Sheet	Doc No	Signature	Date	30UKA (UKA). Reactor building. Floors and foundations for the equipment upto elevation 0,000	Phase	Sheet	Sheets		
Утвержден Approved			Voronova	<i>[Signature]</i>	08.12		WD	7			
Н. контр. Inspector			Semina	<i>[Signature]</i>	08.12	План полов на отметке -4,200 в осях А-В	 JSC "Atomenergoprom" Moscow 2016				
Разраб. Designed			Ivchenko	<i>[Signature]</i>	04.11	Plan of floors at elevation -4,200 in axes A-B					

format A1

ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF COMPARTMENTS



Номер помещения No of compartment	Наименование Name	Площадь, м² Area, m²	Кат. помещения Category of compartment
30UKB15 R013	Лестничный холл Stairs entrance hall	3КА-11 САО-11 12,18	- -
30UKB15 R014	Помещение воздухопроводов 1 и 2 каналов Air duct compartment of 1 and 2 channels	3КА-11 САО-11 4,06	- -
30UKB15 R015	Тамбур Tambour	3КА-11 САО-11 36,85	- -
30UKB15 R016	Тамбур Tambour	3КА-11 САО-11 8,15	- -
30UKB15 R017	Лестничный холл Stairs entrance hall	3КА-11 САО-11 12,18	- -
30UKB15 R018	Тамбур Tambour	3КА-11 САО-11 36,85	- -
30UKB15 R019	Помещение воздухопроводов 3 и 4 каналов Air duct compartment of 3 and 4 channels	3КА-11 САО-11 4,06	- -
30UKB15 R020	Тамбур Tambour	3КА-11 САО-11 8,15	- -
30UKAI0 R501	Лестничная клетка Staircase	3КА-11 САО-11 13,92	- -
30UKAI0 R502	Лестничная клетка Staircase	3КА-11 САО-11 13,92	- -
30UKAO5 R401	Кабельная шахта №1 первого канала системы безопасности Cable shaft №1 of channel 1 safety system	3КА-11 САО-11 4,25	Б1 В1
30UKAO5 R405	Кабельная шахта №1 четвертого канала системы безопасности Cable shaft №1 of channel 4 safety system	3КА-11 САО-11 4,25	Б1 В1

ЗКД-I - необслуживаемые помещения 'зоны контролируемого доступа'
CAA-I - unattended rooms of 'controlled access area'

ЗКД-II - периодически обслуживаемые помещения 'зоны контролируемого доступа'
 САА-II - periodically attended rooms of 'controlled access area'

- * Категория по взрывопожарной и пожарной опасности
- * Explosion and fire hazard category

1 Марки дверей 30UKB20AB111, 30UKB20AB112 учтены на данной отметке в связи с переконфигурацией помещений.

1 Type doors 30UKB20AB111, 30UKB20AB112 taken into account at this level in connection with changing the destination premises.

Package Number 3 6 2 20
File: R01 KK34 30UKB 0 AR OK WD001_002=0

R01.KK34.30UKB.0.AR.OK.WD001

AЭС "КУДАНКУЛАМ" БЛОК
NPP "KUDANKULAM" UNIT 3

УА(УКВ), Архитектурно-планировочные отехи на отк. +5,400 и выше в осях 1-2. аны на отметках +5 400; +8 100	Статус	Лист	Листов

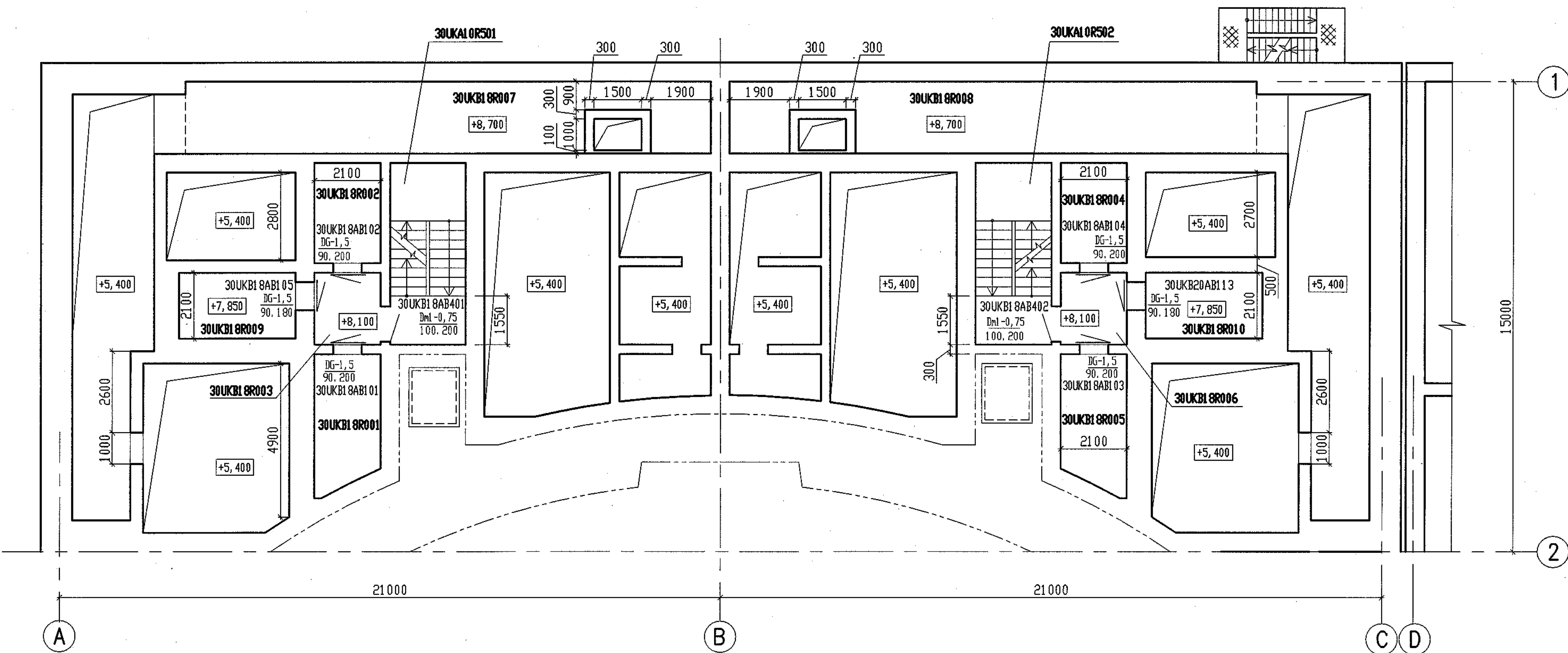
Phase	Sheet	Sheets
WD	2	

АН НА ОТМЕТКЕ +5,400

format A1

opm A1

ПЛАН НА ОТМЕТКЕ +8,100
PLAN AT ELEVATION +8,100



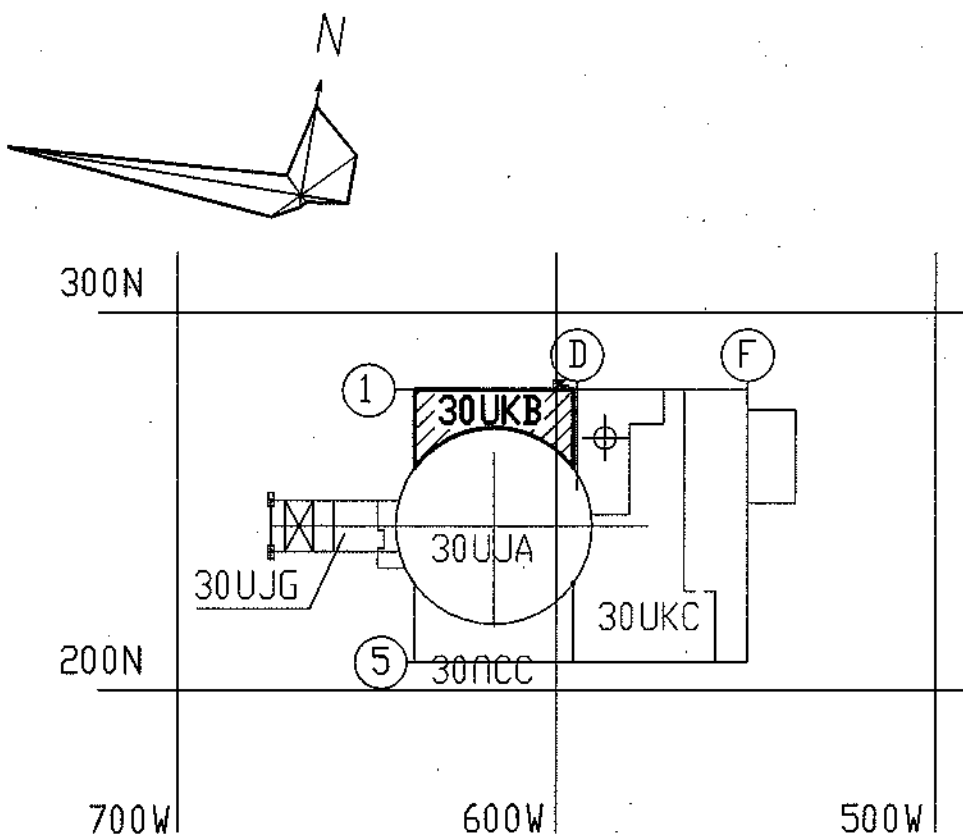
ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF COMPARTMENTS

Номер помещения No of compartment	Наименование Name	Площадь, м² Area, m²	Категория помещения Category of compartment
30UKB18R001	Помещение датчиков ТТК 1 канала PM sensors room of channel 1	9,03	B1 V1
30UKB18R002	Помещение датчиков ТТК 2 канала PM sensors room of channel 2	6,99	B1 V1
30UKB18R003	Тамбур Tambour	4,83	-
30UKB18R004	Помещение датчиков ТТК 3 канала PM sensors room of channel 3	6,99	B1 V1
30UKB18R005	Помещение датчиков ТТК 4 канала PM sensors room of channel 4	9,04	B1 V1
30UKB18R006	Тамбур Tambour	4,83	-
30UKB18R007	Трубопроводный канал Piping duct	35,47	B4 V4
30UKB18R008	Трубопроводный канал Piping duct	35,47	B4 V4
30UKB18R009	Помещение ПК Radiation monitoring system room	8,31	B1 V1
30UKB18R010	Помещение ПК Radiation monitoring system room	8,31	B1 V1

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ
LEGEND

- ЗКД-I - необслуживаемые помещения 'зоны контролируемого доступа'
CAA-I - unattended rooms of 'controlled access area'
- ЗКД-II - периодически обслуживаемые помещения 'зоны контролируемого доступа'
CAA-II - periodically attended rooms of 'controlled access area'
- * Категория по взрывопожарной и пожарной опасности
* Explosion and fire hazard category

СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



- 1 Марки дверей 30UKB20AB113 учтены на данной отметке в связи с переконпановкой помещений.
- 1 Type doors 30UKB20AB113 taken into account at this level in connection with changing the destination premises.

Package Number 3 6 2 20
File: R01.KK34.30UKB.0.AR.OK.WD001_003=0

R01.KK34.30UKB.0.AR.OK.WD001

АЭС "КУДАНКУЛАМ" БЛОК
NPP "KUDANKULAM" UNIT 3

Изм. Кол. у. Лист N док. Подпись Дата
Rev. Qty. pers. Sheet Doc. No. Signature Date

Утвержден
Approved

Н. комп. Инспектор
Inspector

Разработчик
Designed

План на отметке +8,100
Plan at elevation +8,100

Атомэнергопроект
Atomenergoproekt

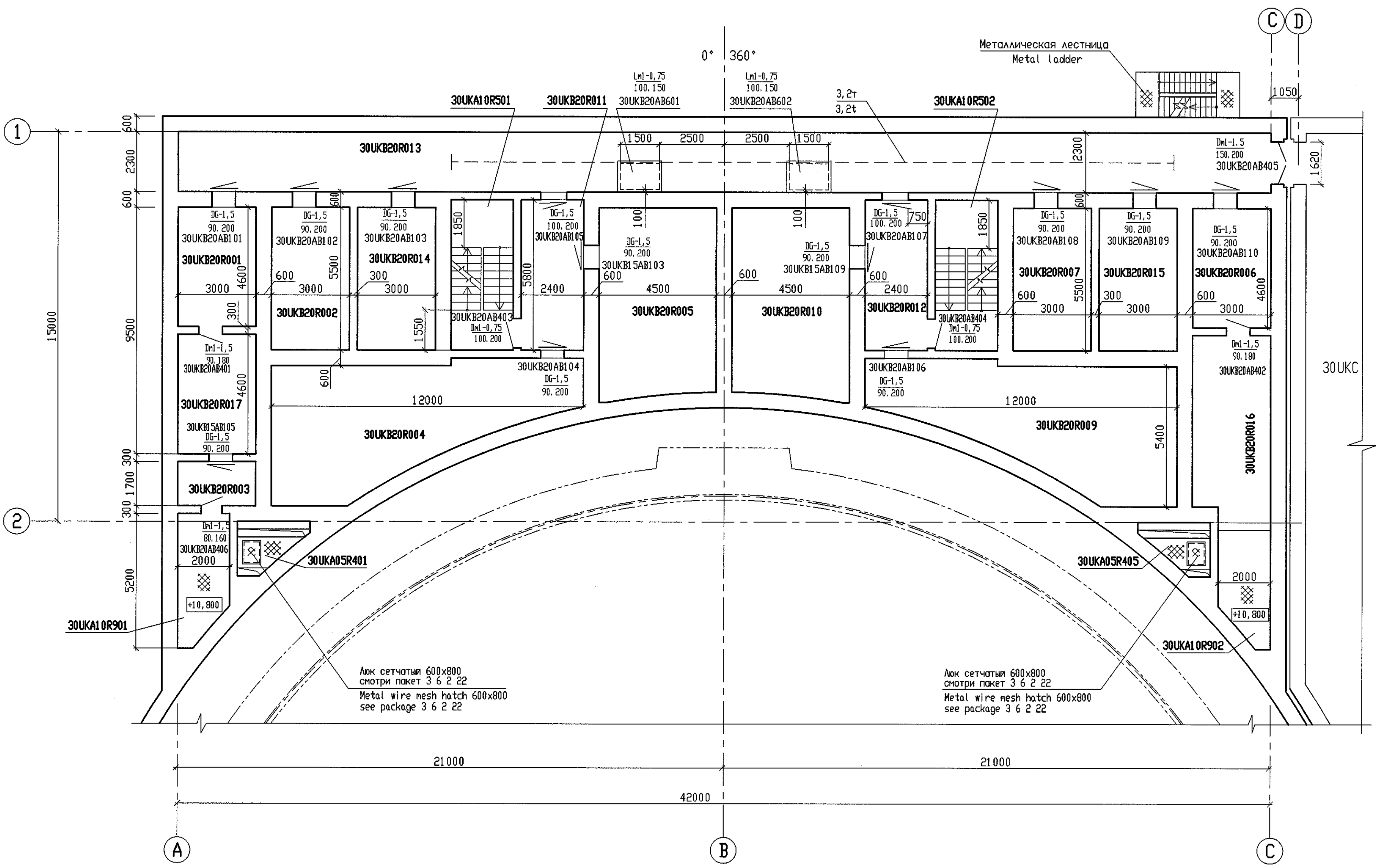
формат А1

Orig. arch. Nr. Replace arch. Nr. Date

2014 08.09.14

2014 08.09.14

ПЛАН НА ОТМЕТКЕ +10,800
PLAN AT ELEVATION +10,800



ПЛАН НА ОТМЕТКАХ +14,400; +15,600
PLAN AT ELEVATIONS +14,400; +15,600

ЭКСПЛИКАЦИЯ ПОМЕЩЕНИЙ
EXPLICATION OF COMPARTMENTS

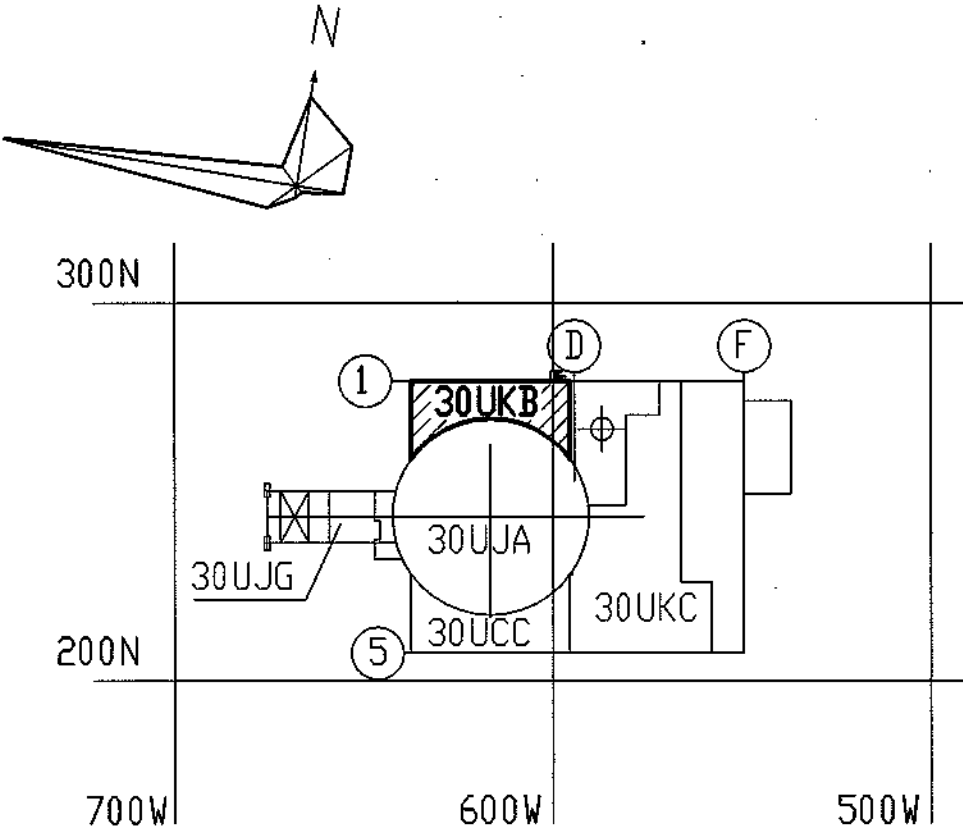
Номер помещения No of compartment	Наименование Description	Площадь м ² Area, m ²	Кат. помещения Category of compartment
+14,400			
30UKB24R001	Помещение фильтров 30KLC23 Filter compartment 30KLC23	56,89	B1 V1
30UKB24R002	Помещение фильтров 30KLC23 Filter compartment 30KLC23	47,74	B1 V1
30UKB24R005	Помещение приточной противодымной установки Compartment of inflow antisnake plant	25,29	A D
30UKB24R006	Помещение приточной противодымной установки Compartment of plenum smokeprotect	25,29	A D
30UKB24R009	Помещение фильтров 30KLC24 Filter compartment 30KLC24	47,74	B1 V1
30UKB24R010	Помещение фильтров 30KLC24 Filter compartment 30KLC24	56,90	B1 V1
30UKB24R011	Коридор Corridor	96,60	- -
30UKB24R012	Вентиляционное помещение Vent room	14,16	B1 V1
+15,600			
30UKB25R001	Помещение датчиков ТТК PM sensors room	13,50	B1 V1
30UKB25R002	Помещение датчиков РК RM sensors room	9,87	B1 V1
30UKB25R003	Тамбур Tambour	3,94	- -
30UKB25R004	Помещение датчиков РК RM sensors room	9,87	B1 V1
30UKB25R005	Помещение датчиков ТТК PM sensors room	13,50	B1 V1
30UKB25R006	Тамбур Tambour	3,60	- -
30UKB25R007	Воздухозаборная шахта Air intake shaft	6,78	- -
30UKB25R008	Воздухозаборная шахта Air intake shaft	6,78	- -

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ
LEGEND

ЗКД-II - периодически обслуживаемые помещения "зоны контролируемого доступа"
CAA-II - periodically attended rooms of "controlled access area"

* Категория по взрывопожарной и пожарной опасности
* Explosion and fire hazard category

СХЕМА РАСПОЛОЖЕНИЯ
KEY PLAN



Package Number 3 6 2 20
File: R01.KK34.30UKB.0.AR.OK.WD003_002=0

R01.KK34.30UKB.0.AR.OK.WD003
АЭС "КУДАНКУЛАМ" БЛОК 3
NPP "KUDANKULAM" UNIT 3

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							АЭС "КУДАНКУЛАМ" БЛОК 3						
							NPP "KUDANKULAM" UNIT						
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of the JSC "Atomenergoproekt"	Изм.	Кол. уч.	Лист	N	год	Подпись	Дата	30UKB(КБ). Архитектурно-планировочные чертежи на отм. +5,400 и выше в осях 1-2 План на отметках +14,400; +15,600			Статус	Лист	Листов
	Rev.	Qty pers.	Sheet	Doc.	No	Signature	Date	30UKB(КБ). Archt. tectural -layout drawings at el. +5,400 and above in grid lines 1-2 Plan at elevations +14,400; +15,600			Phase	Sheet	Sheets
	Утвержден Approved					Voronova	10.08.19				WD	2	
	Н. комп. Inspector					Semina	10.08.19	План на отметках +14,400; +15,600			JSC "Atomenergoproekt" Moscow 2017		
	Разраб. Designed					Egorova	10.08.19	План на отметках +14,400; +15,600					

Orig. arch. Nr. 24456
Date 08.08.14
Replace arch. Nr.