

# VOLUME – IA Part I & II

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED



# TECHNICAL CONDITIONS OF CONTRACT

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## VOLUME – IA PART – I CHAPTER – I

### PROJECT INFORMATION

1.1	PROJECT TITLE	:	KUDANKULAM NUCLEAR POWER PROJECT UNIT 3 & 4
1.2	PLANT CAPACITY	:	2X 1000 MWe
1.3	TYPE OF PROJECT	:	GREEN FIELD
1.4	OWNER	:	NUCLEAR POWER CORPORATION OF INDIA LIMITED
1.5	PLANT LOCATION	:	KUDANKULAM PO, RADHAPURAM TALUK, TIRUNELVELI DISTRICT, TAMILNADU - 627106
1.6	NEAREST TOWN	:	NAGERCOIL (41KM)
1.7	NEAREST RAILWAY STATION	:	KANYAKUMARI (35KM)
1.8	NEAREST AIRPORT	:	TUTICORIN (131KM)

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## VOLUME-IA PART-I CHAPTER – II

### SCOPE OF 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.)

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1.2.5	BUILDING AND SYSTEM DESCRIPTION
1.2.6	RECEIPT OF MATERIAL, SHIFTING, STORAGE
1.2.7	SEQUENCE OF ACTIVITIES
1.2.8	INTERFACING WITH OTHER AGENCIES AND TERMINAL POINTS
1.2.9	PREPARATIONS OF WORK PROCEDURES
1.2.10	MANUFACTURER'S INSTRUCTION & SUPERVISION AT SITE
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1.2.19	MISCELLANEOUS WORKS
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1.2.22	HOUSEKEEPING, CLEANLINESS & DEWATERING
1.2.23	GENERAL TECHNICAL REQUIREMENTS
1.2.24	SCAFFOLDING
1.2.25	RECORDS AND REPORTS
1.2.26	COMPLETION OF WORK AND SUBMISSION OF CCC & MATERIAL

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Annexures	
Annexure-I	List of abbreviations
Annexure-II	List of KKS Codes
Annexure-III	Buildings description
Annexure-IV	Systems description
Annexure-V	Pipe sizes of Free issue materials
Annexure-VI	List of NPCIL approved brands of welding consumables
Annexure-VII	Technical specification for Grit Blasting & supply and application of Painting

## 1.2.1 BROAD SCOPE OF WORK

Erection, alignment, welding, NDT, flushing, hydro testing, fabrication of structural steel, pipe supports, metal structures, supply & application of primer & finish paints as per requirement of Sea water piping system and all associated Piping in tunnel, buildings & buried portion including excavation, sand filling, construction of Inspection chamber and handling at site stores / storage yard, transporting to site at KUDANKULAM NUCLEAR POWER PROJECT UNIT 3 & 4, TAMILNADU.

List of abbreviations used in this tender is given in **Annexure-I**.

## 1.2.2 GENERAL

In general, the scope of work shall comprise of but not limited to the following:

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

1.2.2.1 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 & submitted based on actual quantum of work indicating resources required by the contractor to achieve the agreed targets.

1.2.2.2 Training and qualification of contractor personnel: The contractor personnel shall be conversant with Russian codes and standards. Contractor quality personnel shall be assessed by NPCIL, before engaging them in work.

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- 1.2.2.3 Establishing contractor's 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.
- 1.2.2.4 Facilities like site office and field offices, sheds, closed and open workshops, mock up area, test facilities, etc as required by the contractor shall be arranged by him at his own cost. Prior approval of the engineer shall be obtained in respect of locations, layout and details of these buildings. After the work is over, these temporary facilities shall be removed by the contractor at his expense to the satisfaction of the Engineer within the days specified by the engineer from the date of completion. All the activities of the contractor shall be confined to areas authorized by the Engineer-in-charge. The contractor shall be liable for any and all damage caused by him to the NPCIL Corporation's premises.
- 1.2.2.5 Fabrication, erection, welding, inspection, NDE and hydro/Pneumatic testing of CS/SS/Titanium pipes, supports and valves issued as free issue materials by NPCIL including arrangement of temporary structures & supports, supply of all welding consumables (except welding electrode, filler wire), Stub/O-let drilling and passivation of SS pipelines. The scope includes testing of valves at Valve Testing Facility and fabrication and erection of temporary loops for flushing of equipments and pipelines.
- 1.2.2.6 Fabrication, erection, inspection and hydro testing of HDPE including arrangement of temporary structures & supports in Turbine building.
- 1.2.2.7 Fabrication, erection, inspection and hydro/Pneumatic testing of CS/HDPE pipes, fittings, supports, tanks, valves in sea water structures, tunnels and buried portion. The scope includes excavation and backfilling and access well construction.
- 1.2.2.8 Supply, fabrication, erection, inspection, NDE of metal structures, fixing of anchor fasteners- Hilti make, concrete core drilling and core cutting.
- 1.2.2.9 Surface preparation by grit blasting or paint removal including supply of grit/ paint remover, supply and application of paint.
- 1.2.2.10 Surface preparation and supply & application of anti-corrosive painting of field joints for sea water systems and its inspection.
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- 1.2.2.11 Receipt of free issue materials from BHEL/NPCIL's stores, uncrate, inspection and preparation of incoming material inspection report (IMIR), reporting deficiency if any to BHEL/NPCIL, shifting from NPCIL's store to BHEL/contractors store, storage, preservation, material management, shifting from BHEL/contractor's storage to erection site, handling of materials during erection/construction and inspection before erection of items including return of empty crating of FIM to BHEL/NPCIL's store.
- 1.2.2.12 Supply of materials under contractor scope, inspection and preparation of incoming material inspection report (IMIR), storage, preservation, material management, shifting to erection site, handling of materials during erection/construction. For executing the work on BHEL/contractor's supplied material, the supply of welding electrodes, filler wires, and welding consumables are in the scope of contractor, ***whereas for executing the work on free issue material from NPCIL, welding electrodes and filler wire will be issued as FIM and only supply of welding consumables will be in the scope of contractor.***
- 1.2.2.13 Preparation of work procedures and QAP, qualification of welding procedure and welders.
- 1.2.2.14 Preparation of reports for the works carried out and digitalization of RT films.
- 1.2.2.15 Preparation of CCC and material accounting and submission to BHEL & NPCIL for acceptance.
- 1.2.2.16 All reports shall be entered in Construction management software provided by NPCIL/BHEL for material supply, erection activities, protocols, measurements & billing. Agency shall provide required data entry operators along with computers & printers with in the quoted rates.
- 1.2.2.17 Deployment of qualified manpower, supervisory staff and training & qualification of personnel and arrangement of Plant and Machinery, tools & tackles, scaffoldings, ladders, platforms etc.
- 1.2.2.18 Housekeeping, dewatering preservation including supply of preservative consumables.
- 1.2.2.19 Preparation and submission of detailed work schedule to meet the specified targets using latest project management tools and facilities.

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### **1.2.3 REFERENCE DRAWINGS, DOCUMENTS & SPECIFICATIONS:**

- 1.2.3.1 The KKNPP-3&4 units are designed by Russian Federation. Accordingly assembly, fabrication, erection, inspection, testing activities of all the pipelines, pipe fittings, valves, supports and all other components and all other technical requirements shall be as per the Russian Standards and Codes. This Technical Specification is compiled based on the Russian Standards and are only for the guidance of the contractor. Erection of piping shall be done based on the Working Documents and for more details contractor shall have to follow Russian NTD/GOST/SNiP/RD/OST/OTT/PNAEG/PiNAE/SN/VSN/TU/TY as specified in Working Drawings (WD) released for construction and manufacturer documents which will be progressively issued to the contractor during execution of work. The Russian Standards and codes are available with NPCIL Engineer In-charge's library for reference. Working documents (set of drawings and documents) will generally contain necessary information for erection and testing of pipeline and equipment.
- 1.2.3.2 It is the responsibility of the contractor to study & understand all the pre-requisites & conditions like availability of work front, labour, material, consumables etc before the start of the work. BHEL/NPCIL will issue WD's from time to time to the contractor.
- 1.2.3.3 The specifications for execution of work are based on Russian standards and codes, which will be issued only to the successful bidder along with working documents.
- 1.2.3.4 In the event of conflicting requirements between the specification and drawings, the governing requirements shall be at the discretion of the ENC of the work. In the instance where contractor is unable to achieve the required technical parameters, he must apply to the ENC with full justification for the regularization of non conformance. Any deviation from technical requirements must be recorded and duly approved by the Engineer in-charge.
- 1.2.3.5 Working drawings will be issued during the course of execution of work to match the progress of the work in the phased manner. The contractor shall prepare detailed fabrication / shop drawings where ever required based on the design drawings supplied by BHEL/NPCIL.

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- 1.2.3.6 Any discrepancies or contradictions in, 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 in-charge. Written instructions or explanations will then be issued by the engineer as soon as possible.
- 1.2.3.7 All dimensions shown on the drawings that 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. The required dimensions of closing pieces of piping as indicated on the detailed drawings must be established by direct field measurements.
- 1.2.3.8 In case the Contractor feels that the drawing issued by the Engineer does not provide sufficient details required to prepare shop drawings, the Contractor shall obtain the Engineer's consent in writing, to design the additional details and prepare the shop drawing from the design drawings issued to him. Where standard joints are not available, the Contractor shall design connections as per standard practice of design and shall get Engineer's approval prior to fabrication.
- 1.2.3.9 The shop drawings prepared by the Contractor shall be submitted to the Engineer for comments and approval. The Contractor shall also incorporate the comments offered by the Engineer or his authorized representative and resubmit the drawing to the Engineer for approval. The Contractor shall prepare and get approval of all the required drawings within the stipulated time schedule of the works.
- 1.2.3.10 Inadequacy in detailing in Engineer's drawing shall be brought to the notice of the Engineer within 3 (Three) days of receipt of drawings by the Contractor.
- 1.2.3.11 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.
- 1.2.3.12 Design Concession Request (DCR) shall be raised for non-generic deviation and non-conformances and it has to be regularized as per Quality management system.

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### 1.2.4 KKS code:

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Tender Specification No.: BHEL: PSSR: SCT: 1987

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In KKNPP 3&4 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. The list of KKS codes of all the systems and structures which are part of this tender is given in **Annexure-II** to this section. Under the KKS coding system, apart from system and structures identification, each component/equipment in a system is identified by a certain code. 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.

## **1.2.5 BUILDING AND SYSTEM DESCRIPTION:**

### **1.2.5.1 Building description:**

The erection of equipments & piping systems covered under this tender document shall be in Turbine Building (UMA), Turbine & Generator Oil buildings (UMV), emergency oil discharge structure (UMW), Normal operation power supply building (UBA), process tunnels (UGZ), Main pump house (UQA) Essential load pump house (UQC), Intake structure (UPC), Fish protection facility (UPX), Siphon wells (UQX), Fore bay (UPU), Inlet pipeline (UPN), Essential load pipeline tunnels (UQZ), controlled access area waste water treatment plant (UGT,UGW), Reactor building (UJA,UKA) and other ancillary buildings within the plant site of KKNPP- 3&4.

A brief description of all the associated buildings and structures are given in the Annexure-III of this section.

### **1.2.5.2 System and equipment description:**

The piping system covered under this tender document are related to sea water and its associated systems. Sea water and its associated

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systems mainly consists of Main sea water cooling system, Sea water cooling system for essential loads, Sea water cooling system for non-essential loads, Closed cooling water system for conventional area, Systems of dewatering, Screen and flume wash out systems, Common plant systems, Fish protection and diversion system, SS piping system for air supply at the pump houses and Controlled access area waste water treatment systems

A brief description of all the associated systems is given in the **Annexure-IV** of this section.

### **1.2.6 RECEIPT OF MATERIAL, SHIFTING, STORAGE:**

#### **1.2.6.1 Receipt and shifting of materials:**

1.2.6.1.1 The scope of material shifting covers identification of material, preparation of CIV, clearance from EIC and its submission to BHEL/NPCIL's stores, receipt, handling, loading on to the truck/trailer, shifting of materials from BHEL/NPCIL's stores to contractor's store or erection site, unloading the material at 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 NPCIL's stores, returning of un-erected materials to NPCIL's stores. This work also includes arranging all the necessary tools and tackles, truck/trailer, plant and machinery, man power and consumables.

1.2.6.1.2 All such materials which are issued to the contractor by NPCIL during the contract period shall be treated as Free Issue Material (FIM). The WD's issued to the contractor contains the list of the items required for erection of piping. The contractor shall make note of such items and draw the items from NPCIL stores on requisition. The free issue material will be issued against contractor issue voucher (CIV) at BHEL/NPCIL stores. The contractor shall prepare Contractor Issue Voucher (CIV) either using BHEL/NPCIL certified software's like IPMIS, IBA-CMM or manually using CIV book which shall be issued to contractor during the execution of work. Contractor shall establish facility for software based material management system for free issue materials, compatible with the

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- BHEL/NPCIL's software. The CIV should contain all the details of the requested material and the same shall be submitted to department of stores through EIC. It is the responsibility of the contractor to collect the requested material from the designated location of the BHEL/NPCIL stores once the materials is issued.
- 1.2.6.1.3 The Contractor shall draw the FIM from the NPCIL's stores located within the plant premises or in the vicinity of the plant premises.
- 1.2.6.1.4 The Contractor shall be responsible for shifting of all the items / general equipment / material, piping materials from the NPCIL's store / Contractor's store / shop to the place of work/ installation. In no case the equipment/piping material will be delivered by NPCIL at the actual place of erection.
- 1.2.6.1.5 After receiving the materials contractor shall carry out uncrating, visual inspection to check for any damage, inspecting the contents for deficiency if any, checking for the completeness, preparation of Incoming material inspection report (IMIR), shifting up to erection site, handling and storage. Further shifting to the erection point, shifting of materials from contractor's store to erection site and disposal of the crating /packing material at the designated place of the NPCIL's stores will be the responsibility of the contractor. The FIM shall be issued in a lot, in packed/as received condition. No piecemeal issue/delivery shall be permitted.
- 1.2.6.1.6 Loading and unloading of materials and equipment shall be hoisted or skidded so as to avoid shock or damage. Under no circumstances 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.
- 1.2.6.1.7 In the erection place, some rooms (floor & walls) are provided with stainless steel liner. Contractor shall take extreme care while shifting and erecting the equipments and piping to avoid damage to the room liners. The scaffolding used in the area shall have rubber bushing to avoid scratch & dents on the liner and finished floors.
- 1.2.6.1.8 The contractor shall arrange all tools & tackles, machinery and hoisting required for loading, shifting and unloading of the materials. Wherever the contractor has to attach his hoisting equipments to project's existing structure written procedure of rigging operation must be submitted for the engineer's approval. In the work area where the engineer may have

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installed hoisting equipments in time, which is part of the project as permanent installation, the contractor may be permitted to utilize it free of charges for the execution of his work. The same does not apply in the event of the engineer's permanent hoisting equipment is not available or engaged for other work or being out of order. This shall not be the cause for claims of extra payment or an excuse for delays in executing the work. This facility is offered purely on the ground to increase safety of hoisting operations and to remove unnecessary congestions, if and where possible. The contractor shall check the lifting capacity of various hoisting equipments before taking up any erection.

1.2.6.1.9 Disposal of crating/packing materials to NPCIL store is in the scope of Contractor.

1.2.6.2 **Storage of materials:**

1.2.6.2.1 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 storage arrangements to provide appropriate storage at site for all NPCIL issued FIM's, Contractor's Plant & Machinery and Contractor's Equipments till the completion of the work. 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.

1.2.6.2.2 Once materials are issued to the contractor it is the responsibility of contractor in storing of any materials and pre-fabricated items at erection location in the building or enclosures providing adequate protection. All storage shall be orderly and executed in a way so as to eliminate mixing up of materials 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 on the floor. Supports shall be provided below to ensure gap of 100 to 150 mm from ground. 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 by a pre-fabrication stage (such as cutting, washing, pickling) but immediately on completion of this stage the

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particular segment is to receive pipeline system code number. Special tags, bearing system code numbers provided on equipment and items like valves, etc. should not be removed or tampered with, lack or loss of above described identification marks shall be brought to the attention of the engineer.

- 1.2.6.2.3 The Contractor shall be responsible for security of all the FIM's stored at the contractor's stores till the completion of the work and acceptance by 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. All such records which are required for material accounting and billing shall be prepared, recorded and maintained by the contractor either manually or by using licensed software's with prior approval of ENC. 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.

1.2.6.3 **Identification, marking and segregation of material:**

- 1.2.6.3.1 In NPCIL stores, all the equipments and pipelines are identified by their KKS codes and Item no's. It is the responsibility of the contractor to get the details of KKS codes, package no's, Item no's for such materials from NPCIL. All the FIM's shall be stored at appropriate locations in contractor's stores, properly tagged and identified for segregation from other goods, properly protected and preserved as per manufacturers recommendations, properly marked with their KKS code, system Code, Item no. and item description like weight, material, type etc and the material locations shall be marked properly for easy identification and retrieval of the material at stores.

- 1.2.6.3.2 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.

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- 1.2.6.3.3 All materials to be used in piping installation shall conform to the specification issued by the engineer. No substitution of equivalent materials permissible unless approved by Engineer. Manufacturer's certificates attesting compliance of the material with the specification shall be retained in the engineer's record for the project. The certification shall include identification details, a certified report of the results of all the required tests, examinations, and repairs performed on the material.
- 1.2.6.3.4 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 as per engineer's instruction.
- 1.2.6.3.5 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. 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.
- 1.2.6.3.6 The marking shall consist of the applicable specification number, Grade/Type, and any non-destructive testing. In those cases where size or shape prohibits, a marking code shall be used that identifies the material with the certification report.
- 1.2.6.3.7 When a part is cut to make more than one component the marking shall be transferred to all the pieces. When materials shall be marked by any method that will not result in any harmful contamination or sharp discontinuities and which will identify the material until the system is completely installed. Materials of 6 mm and greater in thickness may be marked by stamping. When stamping is used, it shall be done with round-nose continuous or round-nose interrupted dot low stress die stamps. Vibro etching is permitted on all thickness provided minimum wall thickness requirements are met and marking is acceptable to Engineer. Pipelines and sub-assemblies shall be identified in accordance with the code number assigned on the working drawings.

### **1.2.7 SEQUENCE OF ACTIVITIES:**

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The sequence of erection shall be decided 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 installation of equipments shall be taken up first followed with installation of piping and valve system. The following shall be the preferred sequence of installation.

- Painting of equipment and piping
- Equipment installation with support structures and inspection
- Installation and inspection of supports for large diameter piping.
- Erection of pre-fabricated large diameter piping spools (100 NB and above) and supporting them on already installed supports.
- Erection and field welding of the remaining piping (small diameter) and installation of their supports.
- Inspection, Testing and flushing of piping Circuits
- Anticorrosive coating of equipments and piping

### **1.2.8 INTERFACING WITH OTHER AGENCIES AND TERMINAL POINTS:**

#### **1.2.8.1 Interfacing:**

1.2.8.1.1 The civil construction work is under progress by other agencies, hence required co-operation shall be established by the mechanical contractor for smooth progress of work. Construction of civil works shall be continuing in other part of the same building where equipment and piping are being erected. 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 the co-ordination with other contractors/agencies working in that area for erection of ducting, cable tray, etc., will be required. This is to avoid unnecessary cutting and re-welding of ducting, cable trays, their supports, etc., for taking fabricated pipe spools in the required locations. Contractor shall not consider this type of parallel working as disturbance or hindrance to erection work.

1.2.8.1.2 All mechanical erection work covered under this specification shall be planned and executed as combined nature of civil, mechanical, electrical and instrumentation work. The civil construction and mechanical erection works shall be done in a sequential/combined manner. The work front for civil and mechanical contractor shall be available or released on

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- completion of specified activities by each contractor on every activity and both contractors shall ensure that their part of work is completed in time. The rate quoted by bidder shall include such combination of civil, mechanical, electrical and instrumentation work. No extra claim on account of any misunderstanding or not understanding the nature of work shall be entertained by BHEL/NPCIL.
- 1.2.8.1.3 As the scope of work involves erection of materials supplied by the contractor/BHEL as well as supplied by Russian Federation (Free issue Materials), the dimensional mismatches between the connecting components shall be suitably fabricated and joined by the contractor.
- 1.2.8.2 **Terminal points:**
- 1.2.8.2.1 The terminal points for the system piping with respect to the buildings shall be indicated on the working drawing. Generally terminal points will be the 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.
- 1.2.8.2.2 The piping connection to the various equipments/embedded pipes and to terminal points of work done by other agencies is included in Contractor's scope of work. The Contractor shall also make suitable drawings required for such connections, if not already existing. Cutting/opening of blanks (as per Engineer's instructions) and edge preparation etc. at such terminal points, shall be carried out by the contractor.
- 1.2.8.2.3 Service pipe lines supplying water, air, oil if any shall be terminated by other contractor one meter away from the wall either inside or outside of the building. Contractor shall connect to these lines and erect lines inside the buildings as per the WD.
- 1.2.9 **PREPARATION OF WORK PROCEDURES:**
- 1.2.9.1.1 The contractor shall prepare and submit work procedures for fabrication, erection, inspection and testing all the piping, painting and structural works in his scope to EIC for approval. The procedures shall be prepared in line with the general Industry practice, Working Documents, acceptable codes and standards and to the requirements of Equipment Manufacturer/Designer. The procedures shall clearly define

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- all the details pertaining to the type of testing, process of testing, the methodology adopted, special requirements, sequence of steps, fabrication requirements, assembly requirements, alignment process, quantum of testing, testing tools & consumables required, calibration requirements, testing parameters, sampling requirements, interpretation of results, defect rectification methodology.
- 1.2.9.1.2 Contractor shall prepare Welding Procedure specification (WPS), Procedure Qualification Record (PQR), assembly, NDE, cleaning, etc.
- 1.2.9.1.3 Contractors shall ensure that all construction activities are performed following duly approved Procedures, methods and work instructions. All hazardous activities shall be duly identified, Procedures duly formulated for the same, approved and implemented, and continuously monitored for their effective implementation. Job Hazard Analysis (JHA) shall be undertaken, updated (if required) and documentation to this effect maintained.
- 1.2.9.1.4 Further, where complexity of the work or safety is involved, the contractor shall submit such work procedures when requested by the EIC. Any other procedure deemed necessary for work shall be submitted to EIC for acceptance.
- 1.2.9.1.5 Contractor shall provide supervising/drafting assistance for various miscellaneous activities as instructed by BHEL Engineer for carrying out site dimensional measurements, as built checking, AutoCAD drafting etc.
- 1.2.9.1.6 Contractor has to provide dedicated engineer (1 no) with PC with AutoCAD software at BHEL site office to prepare work procedures, work instructions, JHA's, reports & protocols, as built drawings, other documentation works as instructed by BHEL Engineer. Computers shall have latest configuration of Windows 10 OS, 8 GB RAM.
- 1.2.9.1.7 Qualification and Experience required:
- i. DME (Mechanical)
  - ii. Persons with 3 years' experience in any mechanical construction project will be preferred.
  - iii. Should be proficient in AutoCAD, 3D drafting and isometric drawings and MS office.

### **1.2.10 MANUFACTURER'S INSTRUCTION & SUPERVISION AT SITE:**

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1.2.10.1.1 Manufacturer's instructions are special/specific instructions issued by the equipment manufacturer. Any such installation requirement specified by the Manufacturers, such as alignment, adjustments, greasing, turning of motors, mounting of particular items 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. For any equipment or items (supplied by the engineer) of proprietary nature, the Engineer will issue the Manufacturer's data or instructions to the Contractor. Contractor shall follow the manufacturer's instructions/data for equipment/items supplied by contractor. The manufactures manual should be returned to NPCIL with deviation marked by the contractor on completion of work.

1.2.10.1.2 Wherever deemed necessary NPCIL may arrange supervisors of manufacturer representative during erection and testing of the equipment/system for pre determined period. The contractor is required to complete the erection of such equipment in a fixed time frame as per agreed schedule. Any delay in completion of work by the contractor within the agreed schedule shall be considered as delay in work. If any additional expenditure incurred by NPCIL on account of delay by the contract or on account of supervision front, shall be deducted from the contractor.

### **1.2.11 WELDING, ERECTION, NDE, FLUSHING AND TESTING OF PIPELINES:**

The scope of piping work involves handling, fabrication, welding, erection of CS/SS/Ti pipes and supports, testing and erection of CS/SS/Ti valves, stub welding & drilling, fabrication and erection of HDPE pipes, GRP/FRP pipes, carrying out NDE, hydro/pneumatic testing of pipelines, making arrangements for flushing and performing flushing operation and digitization of RT films, passivation, flange assembly. Scope includes cleaning, de-preservation of pipe internal and external surfaces using rotary brush, compressed air and manual wiping.

#### **1.2.11.1 General requirements:**

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- 1.2.11.1.1 The pipe lines shall be erected by the contractor as per the working Drawings and documents issued by NPCIL/BHEL.
- 1.2.11.1.2 The scope of work of pipeline covers both free issue material issued by NPCIL and the material supplied by BHEL.
- 1.2.11.1.3 Seawater system Pipe lines shall be erected inside the buildings as indoor pipe lines in various floors including below ground and above ground floors of sea water buildings/structures and associated buildings within plant site of KK 3&4. Pipe lines shall also be erected in various locations as outdoor pipe lines in underground tunnels and above ground supports and outdoor buried pipe lines.
- 1.2.11.1.4 The term "Pipe Line" shall comprise all pipes, pipe fittings, pipe supports and its supporting structure, level gauges, thermo wells, pressure tap bosses, tube zond, vents and drain connections, sampling connections up to and including first isolation valves with threaded nipples, hydro seals/locks, linear separator and other pipe mounted equipments, reinforcing pads for branch connections, valves, valve operators, strainers, traps, flow elements, flanges, gaskets, nuts, bolts, expansion joints, orifices, venturi meter, rotameter, sight glasses, funnel, trays, containment pipe penetration, hanger supports, dampers etc. In brief all items forming part of the pipelines as shown in the drawing shall be considered part of piping. Threaded pipe nipples wherever required will be fabricated by machining by the contractor.
- 1.2.11.1.5 Pipelines shall be erected and joined by welding or flange connections or threaded connections in accordance with the working documentation and tender specification. Pipeline shall be made with the minimum feasible number of joints. The contractor shall pre-fabricate sub-assemblies of piping etc. to the maximum extent feasible.
- 1.2.11.1.6 The free issue pipelines sizes 100 NB and above are big bore dia. with weld edge prepared on both sides for butt welding. The free issue pipelines sizes 80 NB and less are small bore dia. and will be supplied in standard length without prepared weld edges.
- 1.2.11.1.7 Fabrication, erection and welding of pipelines shall be done by the contractor as per working drawings. Edge preparation for welding shall be as per the working drawings and specifications. Big bore pipes and pipe fittings (100 NB and above) will be issued to the contractor with edge prepared for butt welding. If any edge correction or rectification is required

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- in big bore pipelines, the same shall be done by the contractor as part of pipe welding work.
- 1.2.11.1.8 For any cutting and edge preparation of big bore pipelines required to suit the layout of piping is part of scope of work.
- 1.2.11.1.9 Care shall be taken to prevent damage of coating while handling, shifting and erection of anti corrosive coated seawater pipelines (either inner surface or both inner and outer surface).
- 1.2.11.1.10 Adherence to safety guidelines, security guidelines, various work permit system and compliance of all statutory requirements of the project.
- 1.2.11.1.11 For the equipment/component received as fabricated from manufacturer, the field welding if any shall be done by the contractor with prior approval of the EIC and in accordance with relevant code. These activities shall be considered as part of installation of piping etc.
- 1.2.11.1.12 Removal of caps and other closures from all equipment nozzles supplied with temporary caps is included in contractor's scope of work. This shall be considered as part of edge preparation and job shall be done without any extra charges. The removal of caps shall be done by grinding or sawing off only. In case arc gouging is to be done, a written procedure shall be submitted and EIC's prior approval shall be sought. Any damage to the equipment during the process of removal of the caps shall have to be made good by the contractor's at his own cost. After completion of weld joint the open edges of pipes shall be fitted with temporary plastic /steel caps.
- 1.2.11.1.13 Contractor shall prepare all the work procedures with reference to applicable codes and standards and shall submit the same for the approval of BHEL/NPCIL including WPS and PQR for the pipe welding and qualification of welders.
- 1.2.11.1.14 Preparation of reports, documents required at various stages of the work.
- 1.2.11.1.15 Providing man power, all tools & tackles, P&M, consumables, necessary pipe end capping, scaffolding, temporary supports, documentation and report submission, all other arrangement to complete the work as per drawings.
- 1.2.11.1.16 Care shall be taken to avoid foreign material entry into the pipes during all stages of work. Foreign material exclusion check point to be included in the erection procedure and report.

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### 1.2.11.2 **Fabrication and welding of CS, SS & Ti pipelines:**

In addition to the requirements given in clause no 11.1, the contractor shall perform the following activities.

1.2.11.2.1 Fabrication and welding work includes study of drawings & applicable documents, site survey, identification of joints, marking, cutting & edge preparation (where ever required), cleaning, fit up, welding of pipes, fittings and other components of various sizes and thickness using GTAW/SMAW process, cleaning the joint, visual and measuring inspection, repair of welding if any, engraving, preparation & submission of reports, QAP, JHA and other documents, completion of joints including arrangement of man power, plant & machinery, tools & tackles, scaffolding and platforms, consumables, (except welding filler wire & welding electrode), cleaning aids etc and completion of work as per tender specification and drawings. For cleaning, fabrication, edge preparation, fit up and welding of flanges with carbon steel pipes having internal surface coated with anti corrosion paint, the flanges will be of weld neck, slip on type of CS material. Cutting by grinding and removal of paint material from pipe end up to 50 mm, fit up, and welding by GTAW /SMAW and inspection. Weld profile shall be made suitable for application of anti corrosion paint material both inner surface and outer surface. Support pads shall be welded to the pipelines prior to the application of anti corrosive paint.

1.2.11.2.2 For SS welding, identification of pipe spools, joints, cleaning, purging dam fixing & purging, fit up, welding, welding of stainless steel pipes using GTAW / SMAW process, cleaning the joint, visual and measuring inspection, repairing weld joint if any, removing purging arrangements, engraving, preparation & submission of report, arrangements of man power, plant & machinery, tools & tackles, scaffolding and platforms, all consumables (except welding filler wire and electrodes), cleaning aids etc and completion of work as per tender specification and drawings.

1.2.11.2.3 For Titanium (Ti) welding of pipelines in addition to the general requirements of welding the scope includes passivation of weld edge, purging-dam fixing, purging, shielding and trailing gas, welding using GTAW process including hookup joints, visual inspection, repair of welding if any, FME inspection including identification & marking by engraving, preparation of welding inspection report (WIR), purging

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- dam log sheet, consumables (excluding welding filler wire & electrode) etc and completion of work as per drawings and tender specifications.
- 1.2.11.2.4 NPCIL will supply of various electrodes and filler wires for welding of CS/SS/Ti pipes. Contractor shall prepare material accounting for receipt, consumption, wastages and return of electrodes and filler wires and submit to NPCIL.
- 1.2.11.2.5 PEB System: Internally coated pipe lines shall be erected and the field joints welding shall be done in location. 630 mm OD size of tunnel pipeline (PEB) will be welded block by block. While welding the pipeline anti corrosive coating of inner surface of previous joint shall be completed before taking up welding of subsequent joint by the contractor. This weld joint shall be released for coating at site before erection of next pipe block for the pipe size with OD 630 mm and above. For pipe sizes with OD less than 630 mm, the pipe connections shall be with flange joints. To minimize the field joints of flanged connections, fabrication of pipe spools with flanges shall be carried out and coated before moving to site. The methodology of fit up, painting of inner surface of pipes & fittings and erection shall be prepared by the contractor for approval.
- 1.2.11.3 **Erection of CS, SS, Ti pipelines(F8):**  
In addition to the general requirements given in clause no 11.1, the contractor shall perform the following activities.
- 1.2.11.3.1 Erection of pipes on different types of supports at various elevation, locations, alignment of pipes and slope as per the drawing, providing tapping for vents, drain and sampling connections and providing reinforcing pads for branch connections wherever required.
- 1.2.11.3.2 Providing temporary supports for erection of pipelines.
- 1.2.11.3.3 Fixing of pressure & temperature stubs, rotameter, venturies and orifice flanges as per the specifications.
- 1.2.11.4 **Welding requirements:**
- 1.2.11.4.1 Preparation, submission of welding procedure specification (WPS) and conducting Procedure qualification record tests (PQR) as per relevant standards are in contractor's scope of work. In that case an undertaking towards owning full responsibility for achieving the desired quality shall be given by the contractor.
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- 1.2.11.4.2 No welding shall be done on surfaces which are wet or exposed to rain or excessive draft. Surfaces to be welded shall be free from paint, rust, oil, grease, dust or any other contamination. Cloths used for cleaning shall be lint free with hemmed edges. Weld edge preparations shall be cleaned only by use of approved solvents.
- 1.2.11.4.3 Welds shall be cleaned between passes to remove all traces of slag and flux before successive beads or layers are deposited. Completed weldments shall be cleaned to the same extent. The craters at the starting and stopping points of each individual bead shall be carefully examined and any defects shall be removed by grinding. Peening shall not be permitted.
- 1.2.11.4.4 Inspection and Quality Surveillance shall not be limited to examination of the finished weld. All dimensions specified for welding including weld size, reinforcement, edge preparation, fit up etc. shall be checked by gauges approved by the Engineer. All aspects of the materials, fabrication procedures and examination procedures used, that could affect the quality of the finished weld, shall be subjected to the approval of the Quality Surveyor.
- 1.2.11.4.5 The welding equipment to be used shall be suitable for the quality of the work specified and the technique employed shall be based on methods which are known to produce good results and which have been verified at site by actual demonstrations.
- 1.2.11.4.6 All stages of fit-ups to final welding shall be checked and cleared by qualified inspectors/engineers of contractors. Random inspection shall be carried by QA representative of BHEL/NPCIL. All the reports shall be generated and maintained by the contractor.
- 1.2.11.4.7 The welding technique and arc manipulation shall be controlled to ensure the following:
- Full Penetration for groove welds.
  - Full fusion into the preceding bead or layer.
  - Full fusion into the base metal without undercutting along the sides of the weld.
  - Uniformity of surface in both single run passes and beaded layers.
  - Floating all slag, oxide and gases to the surface behind the advancing arc.

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- f. Delay in electrode travel until base metal fusion at the starting point is assured and until the crater is well filled at the completion of the weld.
- 1.2.11.4.8 Haphazard striking of the electrode on the base metal in establishing the arc shall not be permitted. The arc should be struck either in the joint where the metal surface will be fused into the weld or on a starting tab. Starting tabs shall be of the same material or a material compatible with the base metal being welded. When inadvertent arc strikes occur, the areas affected shall be ground flush and then examined by the liquid penetrant method. High frequency arc starting devices shall be used for GTAW process.
- 1.2.11.4.9 Care must similarly be taken when stopping the arc to avoid an unfilled crater and crater cracks. The following techniques are to be used for stopping the arc.
  - a. The arc should be drawn off to the side of the joint and stopped on the beveled surface of the joint while extending the arc length rapidly.
  - b. In GTAW, the machine should ideally be equipped with a foot or hand control to permit a gradual decrease of current. It is then easier to fill the crater completely and prevent crater cracks. Alternatively the arc shall be extinguished as in (a).
- 1.2.11.4.10 During the welding of carbon steel with covered electrodes, the width of the deposited pass shall not exceed three times of the nominal core wire diameter. For vertical position stringer bead is preferred. In GTAW the electrode must be correctly shaped and pointed for DC welding and a spherical end for AC welding. The electrode extension beyond the gas cup should be kept as short as is consistent with the joint being welded. The welding torch should be inclined slightly in the forehand welding position and the filler metal added carefully to avoid contact with the consequent contamination of the tungsten electrode. If contamination does occur, the tungsten electrode shall be cleaned and redressed. Similarly, if the tungsten electrode comes into contact with the weld pool the operator shall break the arc and grind out the tungsten deposit.
- 1.2.11.4.11 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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- 1.2.11.4.12 Utmost care shall be taken while carrying out welding job on equipment nozzle, particularly heat exchangers etc. so that no weld spatter etc. falls inside the equipment.
- 1.2.11.4.13 Joint design: In all instances the edge preparation for welding shall be done as per the working drawings and specifications. In general all pipes and pipe fittings issued to the contractor shall have edge prepared.
- 1.2.11.4.14 Fit-up: Before fitting up the weld joint, the profile and dimensions of the weld edge preparation shall be checked. If the specified tolerances are exceeded this shall be corrected with prior approval, by grinding, machining or any other method acceptable to EIC. All fit-ups shall be examined by the Quality Surveyor prior to welding the root pass.
- 1.2.11.4.15 Weld profile: The surface smoothness of the finished weld shall be suitable for proper interpretation of the non-destructive examination of the weld. If grinding is necessary, the weld shall be blended into the parent metal without thinning the basic wall thickness of the parent or weld metal in any way. Uneven or excessive grinding may be cause for rejection or re-work at the discretion of the Quality Surveyor. Fillet welds shall preferably be slightly convex and shall be free from undercutting and over-lap at the toe of the weld. Convexity shall not exceed 1.6mm. Full fusion shall be obtained at the root of the fillet and in no case shall the leg length of the fillet be less than the nominal weld size stated in the drawings or specification. The leg length shall not exceed the specified size by more than 1.6mm. Dimension specified in the drawing and codes shall be adhered. The weld profile shall be ground smooth without rough edges, sharp corners and spatters, under cuts etc also shall be removed for executing anti-corrosive coating on inner and outer surface of weld joints.
- 1.2.11.4.16 Tack welds: The number and size of the tack welds shall be kept as small as is consistent with adequate strength and joint alignment. All tack welds shall be examined visually for defects and if found defective shall be completely removed. As the welding proceeds, tack welds shall be either removed completely or shall be properly prepared by grinding or filling their stopping and starting ends so that they may be satisfactorily incorporated into the final weld.
- 1.2.11.4.17 Seal welds: Seal welding shall be done by qualified welders and in accordance with approved procedures. Threaded joints that shall be seal

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welded after grinding and removing the threads from the male part at the welding area. The surfaces to be welded shall be cleaned free from paint, grease, oil, rust, seal compound, etc. The threads left outside after making the joint shall be adequately prepared by grinding and circumferentially covered by the 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. Unless otherwise specified on drawings, seal welding size shall be 3 mm minimum.

- 1.2.11.4.18 Fillet welds: Fillet welding of pipelines shall be carried out by qualified manpower by following approved WPQ, WPS and PQR. Fillet welding of SOFF, SORF flanges will be measured in such a way that fillet welding on both the side of the same flange joint will be considered as single joint for Inch-dia measurement. The scope includes cutting of pipes and preparation for fillet welding.

1.2.11.5 **Welding materials:**

Welding materials intended for welding of NPCIL free issue equipment and pipes will be issued by NPCIL as free issue materials to the contractor. Electrodes and filler wires shall be supplied by contractor for fabrication of pipes and materials supplied by BHEL/contractor. The electrodes as specified in the drawings and specification shall be used for the job.

The Russian supplied electrodes will be:

- a. for welding of carbon steel – electrodes YOHIII -13/45, YOHIII -13/55, E42A; filler wire C608r2C
- b. for welding of corrosion-resistant steel, 08X18H10T, 12X18H10T – electrodes EA-400/10Y, EA-400/10T filler wire C6 - 04X19H11M3
- c. For different steels (carbon + corrosion-resistant) – electrodes EA-395/9, filler wire C6-10X16H25AM6.
- d. For titanium pipe welding, special electrodes and filler wires materials as specified in manufacturers drawing and documents.

For materials supplied by BHEL/contractor, only NPCIL approved brand of Electrodes, filler wires shall be used for all the welding works carried

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out by the Contractor. Approved Electrode list shall be issued regularly to the Contractor. Electrodes to be used shall be as per approved WPS/PQR. In case of any deviation, prior approval from EIC shall be obtained. Welding Procedure and Welder Qualification shall be as per ASME SEC IX/PNAEG-007-003-89.

### 1.2.11.6 **Welding process:**

The contractor may use following welding technologies

- 1.2.11.6.1 Manual arc welding with coated electrodes ( SMAW);
- 1.2.11.6.2 Manual argon-arc welding with non-consumable (tungsten) electrodes (TIG/GTAW welding);
- 1.2.11.6.3 Automatic argon-arc welding
- 1.2.11.6.4 Combined welding (bottom run by argon-arc welding; hot pass and final run by manual arc welding).
- 1.2.11.6.5 For HDPE pipes fusion welding.

### 1.2.11.7 **Weld repairs:**

Any weld repair shall be subject to the approval of the Quality Surveyor. No separate measurement and payment will be made for weld repairs and it's NDE including penalty joints.

- 1.2.11.7.1 If weld repairs are necessary, they shall be made using qualified welding procedures by qualified welders and shall be examined by a dye penetrant method, or by radiographic as the EIC may direct.
- 1.2.11.7.2 Unacceptable defects shall be removed by grinding, machining or chipping. Arc gouging or flame cutting are also permitted provided gouged surfaces are ground back at least 1.6mm below the deepest indentation.
- 1.2.11.7.3 If preheat is specified in the appropriate welding procedure then the same preheat must be maintained during flame outting or arc gouging.
- 1.2.11.7.4 Liquid penetrant examinations shall be used to check that the defect has been completely removed prior to weld repair. In the event of any doubt regarding complete removal of a defect, radiography may be required at the discretion of the quality surveyor.
- 1.2.11.7.5 Weld repairs shall be made using qualified procedures and welders. The preparation for the weld repair shall have the prior approval of the Quality Surveyor.

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- 1.2.11.7.6 In the event of several unsuccessful repair attempts or if the Quality Surveyor feels that satisfactory repair is not feasible, the joint shall be completely remade. Due consideration should be given to check the damage to the parent metal.
- 1.2.11.7.7 The re-welded area shall be re-examined by the methods specified for the original weld. Where radiography is required, a minimum amount of 50 mm film overlap beyond the repair edges must be ensured.
- 1.2.11.7.8 Repairs of any base material utilized in fabrication of piping shall not be undertaken unless specifically permitted by the Quality Surveyor.
- 1.2.11.7.9 The areas from which temporary attachments have been removed, shall be dressed smooth and examined by liquid penetrant method by the contractor without separate measurement and payment. Defects, if any, shall be removed and the material shall be re-inspected to ensure that the defects have been removed.
- 1.2.11.8 **Electrode storage, control & monitoring:**  
Contractor shall be responsible for storage, baking, control, calculation and monitoring of electrodes as detailed below.
- 1.2.11.8.1 Storage: The contractor shall receive electrodes and filler wire and store it in a specially developed controlled atmosphere. The temperature of room shall be maintained not lower than +20°C and not more than 50°C. The relative humidity of room should not exceed 50%. Electrodes of different equipment shall be identified till they are consumed.
- 1.2.11.8.2 Electrode baking: The electrode of different type needs to be baked at different temperature. The contractor shall have mother baking oven of heating capacity not lower than 400°C. The baked electrode to site should be stored in a transfer oven to 150°C to 200°C. Electrode to site should be sent only through portable oven with heating range of 100°C and above. Electrode should never be taken to site without ovens.
- 1.2.11.8.3 Electrode control and calculation: On receipt of drawings of the equipment and piping the contractor shall calculate the quantity of electrodes for completion of particular work and inform the EIC within 15 days about the quantity for welding. As soon as electrodes are received along with equipment and piping once again the requirement shall be reviewed. During execution of work the consumption and availability should be recorded and statement should be sent to EIC once in 14 days. As

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soon as particular work is completed, the reconciliation of electrodes should be submitted and records to be maintained.

- 1.2.11.8.4 Monitoring: The electrode receipt, storage, handling, control should be maintained by experienced technical person only. The records should be maintained with the help of computer and proper data system.

1.2.11.9 **Passivation of SS pipes and fittings (F10):**

In addition to the general requirements given in clause no 11.1, the contractor shall perform the following activities.

Contractor shall carryout passivation of SS pipes and fittings where ever required as instructed by the EIC. Scope includes inspection of pipelines, preparation of procedure, supply of consumables, carrying out passivation, supply of preservative materials and carrying out preservation of passivated material, preparation of reports, arrangement of man power, tools & tackles, plant & machinery and cleaning aids.

1.2.11.10 **Assembly of flanged joints (F12):**

In addition to the general requirements given in clause no 11.1, the contractor shall perform the following activities,

All the erected flanges shall be properly cleaned and inspected before assembly of the joint, Orifice plates, fasteners, gaskets shall be issued as FIM by NPCIL. The gaskets shall be cut to the required dimensions, placed in position along with orifice plates where ever applicable and fasteners shall be cleaned, lubricated, installed, aligned, sequentially tightened by torque wrench, providing leak tight joint, preparation of flange alignment report.

1.2.11.11 **Testing of valves (F13):**

Valves shall be issued as FIM for testing and erection. Prior to their installation in the field, all isolation/terminal and check valves are required to be tested for their seat passing, integrity and leak tightness by the contractor. Relief valves and safety valves are also to be tested for opening and resetting pressure for checking the set point and to be adjusted to the required value as mentioned in the working drawing / manufacturers documents. Control valves, Diaphragm valves and

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solenoid valves are not required to be tested for leak tightness at site in valve testing facility.

The scope for testing of valves includes identification, handling, shifting of valves to VTF, de-preservation, cleaning, loading, valve testing, inspection, acceptance of test, preparation of report, demounting of valve from the bed, cleaning, drying with compressed air, re-preservation and capping & tagging of valves, preparation of procedures, arrangement of calibrated pressure gauges, DM/Clean water, compressor, hoses, tools & tackles, manpower, P&M, consumables, cleaning aids etc for the completion of work as per working drawings and documents. During testing of valves, in case the leak rates are beyond the acceptable limits, the valves shall be repaired and reconditioned. Repair and reconditioning of valves shall be carried out by NPCIL. The valves opened for repair shall be retested. Such valve shall be stored separately. The contractor shall arrange man power, P&M, tools & tackles for the shifting of the valve to and from the VTF for testing and after testing. The contractor shall prepare all the necessary test reports to ascertain the successful testing of the valve.

Note: Valve testing facility shall be equipped by BHEL

### 1.2.11.12 **Erection of valves (F14):**

Valves of various size, type and material (CS/SS/Ti), after testing (if applicable) shall be erected at various locations, floors and buildings as per the drawings.

The scope includes handling, shifting of tested valves to location, making temporary support arrangements, installation in design position, alignment, tightening, FME inspection, box-up and preparation and submission of reports. The work also includes preparation of procedures, arrangement of tools & tackles, plant and machinery, required manpower, scaffolding and all consumables. 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 and body etc.

Generally, valves should be welded in open position and heat input kept to the minimum.

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### 1.2.11.13 **Fabrication and erection of pipe supports (F15):**

The Contractor scope of work shall comprise the following:

- 1.2.11.13.1 All structural attachments such as hangers, saddle, eye, spring block, shoe, pad, clip block, structural members and other ancillary's items shall be issued as free issue material to contractor. The scope includes handling, fabrication of the support structures as per the field dimensions at shop, shifting the material from the fabrication shop to the site, straightening, cutting, grinding, bolting, welding, drilling, tightening, fixing and aligning in line and level, bending of rods to make U- clamp, visual inspection, complete for all heights, cleaning, handling assembly and erection of pipe supports of all types which includes activities like study of drawings & plant layout, assessing the availability of work front, planning, shifting, making of staging, lifting, handling, welding & installation in design position, alignment, checking of elevation, inspection, locking and release of springs before and after hydro-test respectively for the pipelines as per the drawings including spring height measurement and preparation of reports.
- 1.2.11.13.2 In some areas, hangers and supports may require drilling of holes on structural steel parts. Embedded parts are provided in the floors and walls for structurally attaching supports to the floors, ceilings and walls. However, in case of any changes in the pipe routing or support locations where EP does not exist the contractor shall install the EP with anchor fasteners. Drilling of holes in concrete wall / floor / ceiling and fixing Hilti anchors are required to be carried out as per drawing.
- 1.2.11.13.3 Supply of Hilti make anchor fasteners is in the scope of BHEL.
- 1.2.11.13.4 Where slope of the pipe for draining is mentioned in the drawing, proper care shall be taken to maintain the slope during installation of supports.
- 1.2.11.13.5 Where CS supports are used for S.S. pipe, S.S. shim sheet shall be used between pipe and support clamp, and supply & cutting of shims is part of scope of work.

### 1.2.11.14 **Stub/o-let drilling (F18):**

Stub/O-let drilling involves study of drawings, identification of pipe spools and O- lets/stubs, handling, shifting the pipe spools to contractor's machine shop marking of position and orientation, drilling of primary

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and secondary holes on pipe stubs/O-lets/equipments/ pipelines of carbon steel /stainless steel in shop/ in-situ using portable magnetic/ other drilling machines with special jigs, fixtures and arrestors along with drill bits/end mill cutter/ special cutting tools, clearing off burrs, removal of metallic chips by pick up tools etc., FME inspection, preparation of reports, arrangement of man power, tools & tackles, plant & machinery, scaffolding and platforms, consumables, cleaning aids etc, as per drawings, documents and specifications. Care shall be taken to avoid damage of threads in pipe stubs/O-lets. The drilling machine used shall have drill bit locking provision so as to prevent falling of drill bits inside the pipes/equipments etc., In general, all the Stub/O-let drilling shall be completed before erection of pipelines. Scope for Stub/O-let drilling is for primary & secondary drilling. The drilling process shall be carried out in number of stages to get required diameter.

Note:

- 1) Stub/O-let drilling is inclusive of both primary & secondary drilling and drilling in number of stages.
- 2) The drilling machine used shall have drill bit locking provision so as to prevent falling of drill bits inside the pipes/equipments

### 1.2.11.15 **Orifice fixing:**

Assembly, welding and erection of all types of Orifices (Spool type and plate type) are included in contractor's scope of work. Orifices if any, which are part of the equipment/pipeline supply shall also form part of the contractor's scope of work. The details of orifices, their location and layout, erection requirements shall be specified in working documents (WD).

In addition to the general requirements of pipelines, the following is the brief Contractor's scope of work for erection of orifices:

- 1.2.11.15.1 The Orifices are to be erected only after completion of flushing and integrity testing of the pipelines.
- 1.2.11.15.2 Orifices shall be assembled, erected, inspected and tested in accordance with the, working documentation, passport documents supplied along with the equipments, manufacturer's instructions, applicable codes & standards and approved standard procedures.
- 1.2.11.15.3 Contractor shall ensure the orifice orientation & flow direction thoroughness of upstream and downstream pressure hole communication

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before erection and shall be as per the working documentation and manufacturer's instructions.

1.2.11.15.4 The general instruction/requirements for assembly and erection shall be detailed in WD or manufacturer's documents.

1.2.11.15.5 Any special manufacturer's instructions regarding assembly, welding, erection etc. shall be strictly adhered to and shall form part of contractor's scope of work.

1.2.11.16 **Vent, drain, manholes or instrument connections:**

The amount of the piping work is established of each major system and by taking into consideration all the requirements described in this document. However, it is to be noted that vent, drain, manholes or instrument connections on equipment or pipelines may start with pipe and terminate with the valve. Such pipe run may not have separate pipeline code numbers because the EIC's operational requirements are satisfied by code number of valves. Therefore, such pipelines are not listed on pipeline list but are included in contractor's scope of work. All such cases shall be shown as details of a particular main line or equipment in the relevant drawings. In case of small diameter pipelines, the routing shown is only for the guidance, but the actual routing shall be as per the field conditions and the contractor shall carry out the work unto the terminal point as directed by the EIC.

1.2.11.17 **Non destructive examination (NDE): (F19 to F22)**

Non Destructive Examinations of welded joints of equipments and pipelines shall be performed by the methods prescribed in working documents. Contractor shall train his NDE personnel for performing the works as per Russian codes and standards. As per the working drawings the quality of weld and extent of Non- Destructive Examinations coverage are based on the category of welds which are defined as follows:

Category I: Welded joints for equipments and pipelines for Group A (Safety class I/QA-1 and Quality group A).

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Category II: Welded joints for equipments and pipelines for Group B (Safety class II/QA-2 and Quality group B).

Category III: Welded joints for equipments and pipelines for Group C (Safety class III/QA-3 and Quality group C) and

Category QNC: Welded joints for equipments and pipelines as per working drawings and functional requirements as per SNiP/GOST standards.

Seawater systems under this scope of contract have category II, III & QNC.

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% & 1%).

Non Destructive Examinations such as Visual and measuring methods, Capillary method, Radiographic method, Ultrasonic method shall be performed by the contractor on the equipments and pipelines as per the requirements of working documents. Contractor shall prepare procedure for each NDE method and submit to NPCIL for approval before carrying out the examinations.

## 1.2.11.17.1 **Visual:**

Includes visual inspection as per the approved standards and procedures by qualified and authorized QA personnel of contractor and BHEL/NPCIL. Visual inspection is part of scope of all the activities of work invariably.

## 1.2.11.17.2 **DPT:**

Performance of Dye Penetrant Test of weld joints of piping, supports and other structures as per working drawing and documents includes activities like identification of the test area/joints, pre-cleaning of joints (test area) and post cleaning after testing, shifting of DPT consumable to location, marking, carrying out dye penetrant Testing by ISNT/ ASNT level-II qualified personnel as per the approved procedure, generating reports, report analysis and submission to BHEL/NPCIL for acceptance including arrangements of equipments, manpower, tools tackles materials & consumables and completion of work as per the tender

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specification, drawings and as per the instructions of the EIC. DPT consumables used shall be as per NPCIL list of approved brand of penetrant materials.

### 1.2.11.17.3 **RT:**

Performance of Radiographic examination (Gamma ray) of weld joints including intersections of piping, supports and other structures as per the working drawings including providing necessary machinery, radiographic sources, radiographic cameras, storage including storage of source at concrete pits, handling, safety arrangements, surface cleaning of welded joints, removal of paint, grease, slags, burrs, spatters both in CS & SS materials, installation and dismantling of scaffolding /platforms, arranging materials, consumables such as radiographic film, developer, fixer etc., marking, carrying out Radiographic Testing by ISNT/ ASNT level-II qualified personnel as per the approved procedure, developing the films, marking, generating reports, report analysis and submission to BHEL/NPCIL for acceptance including arrangement of manpower, tools, tackles and completion of work as per the tender specification, drawings and as per the instructions of the EIC. (Radiographs shall be submitted to EIC along with RT reports after interpretation). To meet the requirements of Russian codes and standards, contractor shall make arrangements for LP/EP penetrometer by machining.

### 1.2.11.17.4 **RT (X-Ray):**

Performance of Radiographic examination (X –Ray) of joints of Titanium piping of thickness 4 mm and less as per the working drawings including preparation and approval of procedures shall carried out be by ASNT/ISNT Level-II qualified personnel. Scope involves, developing of films, interpretation, repeat of RT for repaired joints including providing necessary equipments, sources etc. Collection of RT films of various sizes, generating reports and submit to BHEL/NPCIL for acceptance. Also, work includes scaffoldings, platforms, storage, handling safety arrangements, all manpower, materials, consumables etc & all other arrangement and completion of work as per tender specification

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### 1.2.11.17.5 **UT:**

Performance of Ultrasonic Test of weld joints of piping including intersections, supports and other structures as indicated in working drawings and documents. includes activities like identification of the test area/joints, pre-cleaning of parts and components on test area and post cleaning after testing, Sourcing and calibration of the UT machines with calibration block, shifting of the Ultrasonic flaw detector along with probes and accessories to location, marking, carrying out Ultrasonic Testing by ISNT/ ASNT level-II qualified personnel using both normal and angle probes, generating reports, report analysis and submission to BHEL/NPCIL for acceptance including arrangements of equipments, tools & tackles, materials & consumables and completion of work as per tender specification, drawings and as per the instructions of the EIC.

### 1.2.11.18 **Hydro/pneumatic testing: (F23)**

Contractor shall carryout hydrostatic/pneumatic testing of erected systems. The testing shall be done as specified in the working drawings, specification, applicable Codes & Standards, approved procedures. Hydrostatic/pneumatic testing of pipelines and equipments shall be carried out as part of scope.

The following activities are involved in performing the Hydrostatic/pneumatic testing.

Preparation of Procedures, QAP, test scheme, as built drawings, CRR (Circuit Release Report) for hydrostatic/pneumatic testing of the pipelines and equipments as per the standard documents, drawings and approved procedures including study of the drawings & layout, identification of test pressure, temperature, leak search pressure, hold time etc and conducting the test.

### 1.2.11.18.1 **Preparation** of As built drawings : Involves preparation of Isometric drawings of the piping layout (including supports, pipe fittings and valves ) representing the actual layout at site using 2D drafting software like AutoCAD etc, which includes activities like study of drawings, identification of items no's, pipe spool no's, pipe lengths, support no's, support type, pipe fittings, valves, elevation, study of pipe layout & routing etc, taking measurements at site, reproduction of the actual layout in 2D drawing, marking of supports & their locations, pipe spools & their lengths

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in the drawing, preparation of reports like list of pipe spools, supports, supports types, valves etc including arrangement of draftsmen, licensed drafting software, tools, machinery, printer, computer etc and completion of work as per tender specification and as per the instructions of the EIC. As built drawings shall be submitted in both hard and soft form.

- 1.2.11.18.2 Preparation of CRR: During the construction, all the systems may be divided or clubbed into various circuits. CRR stands for Circuit Release Report, which is a compilation of various reports giving complete information related to a particular circuit (can be of a single system or combination of systems). CRR includes preparation of list of weld joints with WIR no's, Pipes, supports and valves with erection report no's & valve open/close status, WD's with Rev No's, Manufacturer's Documents Identification nos, FCN/ DCN/ ECN, As-built Drawings, test scheme, Line no's, flange Joint with FAR no's, Terminal points and their location with status and exemptions.

The above list is only indicative. The actual list, formats, annexure etc to be part of CRR shall be prepared by the contractor and to be submitted for the approval of EIC.

- 1.2.11.18.3 Testing requirements:
- a. Arrangement of all required manpower, components, high pressure positive displacement pump for pressurization, compressor, hoses, other hardware, pressure gauges, vents, drains, tools & tackles, plant and machinery, cleaning aids etc required for performing hydro/pneumatic testing.
  - b. Water required for carrying out hydro test shall be provided by NPCIL at one point inside the plant premises on free issue basis. However, collection and transportation to the required location & its disposal shall be in the scope of contractor.
  - c. Arrangement of compressed air or nitrogen cylinders for pneumatic testing are in the scope of contractor.
  - d. Preparation of blanks, threaded plugs, using of duly calibrated pressure gauges of required range (gauge range shall not less than one and half times and shall not be more than four times of test pressure), least count and safety and relief valves etc. The contractor shall make arrangements to vent and drain and dry the

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systems, cleaning of areas using suitable solvents where soap solution, masking/tapes and other adhesive tapes are used.

- e. Testing of any one system or circuit may be sub-divided into smaller circuits, if called for by the EIC. These circuits may require to be tested in phases in addition to complete circuit testing. The additional blanking of the circuit/isolation (due to sub division of circuits) shall be in the scope of the contractor at no extra cost.
- f. All defects revealed by the above Hydrostatic/ pneumatic test shall be rectified as per approved procedure by the Contractor. During testing of circuits, if leaks are observed in the equipment and piping such circuits may need pressurization and testing more than once. This re-testing and pressurization will be in the scope of the Contractor and no extra payment for this will be made.
- g. The contractor shall provide and later remove temporary closures for conducting tests and ensure isolation of sub-system or equipment as per procedures without any extra claim. Dewatering of drained water from sumps to the designated points outside the building.
- h. Co-ordination with various agencies and performing hydro/pneumatic test, preparation of final test reports and documents required at various stages of the work and completion of the work

### 1.2.11.19 **Fabrication and erection of HDPE pipelines:**

- 1.2.11.19.1 The work includes shifting, cleaning, handling, welding, joining, fabrication and erection, tightening, visual inspection, testing of HDPE pipelines as mentioned in the erection drawings in Turbine building.
- 1.2.11.19.2 Welding of HDPE pipes will be done by contact heating welding method (butt welding method) by using heating plate. For joint preparation, the pipes and fittings are axially aligned and clamped in the welding machine. Welding equipment used for the HDPE pipe fusion welding shall be of manual/hydraulic type. The welding procedure shall be qualified by suitable mock up joints before start of actual job. Providing tapping for vents and drain connections, sampling connection etc., up to and including first isolation valve, Hydro test of HDPE piping, draining &

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drying with compressed air as required to be carried out. The work includes preparation and submission of procedures for fabrication, erection, welding, arrangement of manpower, consumables, tools, tackles, plant and machinery for completion of the work as per drawings.

### 1.2.11.20 **Normalization of systems:**

It is the responsibility of the contractor to normalize all the system piping for the systems in the scope of this work. This includes activities like removal of temporary blanks, closure of all the exempted joints, welding of hook up joints, release/adjustment of spring tension in supports after testing, removal of temporary supports, closure of open ends by blanking, etc. In short normalization includes all such activities required to bring the system piping, supports and equipment to the conditions as mentioned in the working drawings and documents.

1.2.11.20.1 Closure or hook-up welded joints: The welded joints which are made to connect one piping circuit to another piping circuit, equipment etc. in the end and after performing hydrostatic test on both side of the joints are termed as closure or hook-up welded joints, wherever it is not feasible to subject these joints to hydrostatic test or leak test or both. Such joints shall be treated differently for the acceptance purpose. Each of these joints shall be inspected on every weld pass by liquid penetrant examination or 100% radiographed tested whether or not such inspection requirements have been specified in the specifications and drawing. If UT is specified in the WD, the hook up joint shall also be subjected to UT as per the WD. The contractor shall keep a record of all closure or hook up joint.

1.2.11.20.2 Removal of temporary supports: Contractor shall make arrangements to remove any temporary adjustments, supports, structures etc made during the erection of the piping and equipment. Contractor shall ensure that all such temporary structures shall be properly removed without damaging the equipment and piping. Any damage to the existing structures, piping, component and equipment shall be made good by the contractor at his own cost. Collection, accounting segregation, disposal of the debris, scrap etc to an identified location shall be in the scope of the Contractor. The above activities are part of scope of respective erection work and no separate payment.

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1.2.11.20.3 Release of spring supports: Contractor shall note that for all the spring supports, the spring blocks should be in the locked condition till the completion of the Integrity testing. Once the testing is completed, it is the responsibility of the Contractor, to unlock the springs and set them to the desired value as mentioned in the Working drawings against the respective spring support. Contractor shall prepare and submit a detailed report on the same to the EIC for approval and audit by BHEL/NPCIL.

1.2.11.21 **Digitization of RT films (F31):**

The work includes collection of RT films of various sizes, scanning and digitizing the films, converting to soft form in NPCIL acceptable formats, submitting the soft copies along with proper indexing for easy identification and retrieval, generating reports and submits to NPCIL for acceptance. This work also includes arranging all necessary P&M, manpower, tools, tackles & consumables completion of work as per tender specification.

1.2.11.22 **Fabrication, erection and testing of GRP/FRP piping (F32):**

GRP/FRP pipes and fittings along with resin, catalyst and mat for joining will be issued as FIM to contractor. The scope of contractor covers handling, fabrication, joining, erection & hydro testing of GRP/FRP pipes, preparation of procedures, QAP, JHA, reports, inspection, testing and work completion as per the drawings, documents and specification with acceptance of EIC. The pipe supports to be issued as FIM shall be erected by the contractor. The scope also includes inspection at contractor's store, preparation of IMIR (incoming material inspection report), shifting, cutting, laying of pipes and pipe fittings, qualification of procedures, joining by applying resin and mat, inspection, preparation of as built drawings, draining, drying, de-watering, arrangement of man power, scaffolding and platforms, tools & tackles, P&M.

1.2.12 **ERECTION OF CS PIPING SYSTEMS (G1-G4)**

The work includes handling, erection, edge preparation, welding and alignment at location, inspection, NDE and hydro testing of certain systems like PEB, PUQ, PGB & GKD as explained in the subsequent

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clauses. The scope includes arrangement of manpower, tools and tackles, P&M, scaffolding including supply of NPCIL approved electrodes and filler wires & other welding consumables and work completion as per the drawings and approved documents.

### 1.2.12.1 **CS piping for essential load cooling water system PEB in UQZ tunnel: (G1) (Material supply by BHEL)**

The PEB system is designed as direct flow system with once through circulation of sea water through the heat exchanging equipment. Essential load Sea Water (PEB) is supplied to Reactor building (UJA) and to the DG building (1-4UKD) located outside the sea water pump houses through supply pipelines through the essential load cooling water system safety tunnels (1UQZ and 2UQZ). There are two tunnels (1UQZ and 2UQZ) for each unit. Each tunnel has two channels, each channel has two PEB system pipelines, one for supply and other for return. Each channel starts from UQC building and connects to UKD and UJA buildings and terminates at UQX structure for discharge to sea. The sequence of flange welding with pipes shall be decided by the contractor based on the site layout and tunnel openings. NPCIL will hand over constructed UQZ tunnel progressively to the contractor with necessary erection openings on the tunnel for lowering of PEB pipes. The scope of supply and application of anti-corrosive painting on filed joints including rectification in case of damage during shifting is in the scope of contractor. Shifting of pipes from the BHEL stores/painting shop to the UQZ tunnel and lower the pipes through the erection openings in to the tunnel with contractor's P&M are in the scope of the contractor.

Note:

1. Degree of inspection in NDT for weld joints - 50% RT, 100% UT, 50% Capillary or MPI, is in the scope of the contractor. NDE is a part of scope of PEB piping erection work and no separate payment shall be made.
2. Supply & application of intermediate & finish paints including supply of welding electrodes, filler wires & all consumables, scaffolding & platforms, arrangement of man power, tools & tackles, P&M, preparation of reports and completion of PEB system in UQZ tunnel in all respect for Unit 3 & 4 is in the scope of the contractor. Supply & application of intermediate & finish paint will be paid in respective BOQ.

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3. Supply & application of Kirloskar Make Polyglass 100 Anti-corrosive coating on inner surface of field weld joint of Tunnel piping is in the scope of the contractor. Payment will be made in respective BOQ.

### 1.2.12.1.1 **Proposed erection methodology for PEB pipes in UQZ tunnel:**

- i. Pipes are of sizes - CS pipe OD 630X12 (Weld Joint), CS Pipe OD 530X12 (Flange Joint), CS Pipe OD 406.4X12.7 (Flange Joint), CS Pipe OD 219.1X7.04 (Flange Joint) are to be handled in the UQZ tunnel of PEB, PUQ piping.
- ii. Internally coated pipe lines shall be erected and the field joints welding shall be done in location.
- iii. 630 mm OD size of tunnel pipeline (PEB) will be welded block by block inside the tunnel. The welding shall be smooth profile compatible for anticorrosive coating. While welding the pipeline, anti-corrosive coating & inspection of inner surface of previous joint shall be completed before taking up welding of subsequent joint.
- iv. For pipe sizes with OD less than 630 mm, the pipe connections shall be with flange joints. To minimize the field joints of flanged connections, fabrication of pipe spools with flanges shall be carried out and coated before moving to site.
- v. Pipes to be lowered to the tunnel via erection opening provided at different location either on top of the tunnel or on the sides.
- vi. Pipes to be moved from the lowered/shifted position in the tunnel to the final erection position by means of trolleys/rollers/any alternative arrangements without damaging the pipe surfaces, weld edges, coatings.
- vii. Sequence of erection to be decided and pipes to be numbered prior to start of work. Work instruction with necessary sketches to be submitted for approval to NPCIL before taking up the erection work. Any deviation in the process shall be carried out with prior approval only.
- viii. Pipes to be lowered via erection openings using suitable crane arranged by the contractor.
- ix. Supports shall be painted before erection.
- x. For fixed supports, blocks need to be welded with pipe. The same can be welded with pipe after marking the actual location in the

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fabrication area before taking up the coating or to be welded in position. If the blocks are to be welded in position, the area shall be left without coating, the left out area to be coated insitu along with the welded joint.

- xi. The supports shall be erected either after positioning of pipes or before. The pipe to be slightly lifted or to be moved with temporary arrangements during the process.

The above procedure is only tentative. Contractor to prepare detailed erection procedure and submit to BHEL & NPCIL for approval before start of work.

### 1.2.12.2 **CS piping for drainage system PUQ in UQZ tunnel (G2): (Material supply by BHEL)**

The PUQ is meant for drainage of sea water from PEB system piping to the pits and dewatering from the pits to the outfall .The PUQ system pipeline starts from one point of PEB piping and runs up to drain pit in each channel of UQZ tunnels. PUQ pump (Vertical) has been provided in each pit. The outlet of pump is from the vent chambers UUP and UUQ located at the top of UQZ tunnels. The scope of contractor for execution of PUQ system in UQZ tunnel against this item is from the tapping point of PEB piping, up to the pit and the discharge piping from the pump outlet up to isolation valve located in the UUP, UUQ chamber.

The sequence of flange welding with pipes shall be decided by the contractor based on the site layout and tunnel openings. NPCIL will hand over constructed UQZ tunnel progressively to the contractor with necessary erection openings on the tunnel for lowering of PUQ pipes.

The scope of supply and application of anti-corrosive painting on filed joints including rectification in case of damage during shifting is in the scope of contractor.

Shifting of pipes from the BHEL stores/painting shop to erection site is in the scope of the contractor.

Note:

1. Degree of inspection in NDT for weld joints – 50% RT, 50% UT, 100% MPI or Capillary is in the scope of the contractor. NDE is a part of scope of PUQ piping erection work and no separate payment shall be made.

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2. Supply & application of intermediate & finish paints including supply of welding electrodes, filler wires & all consumables, scaffolding & platforms, arrangement of man power, tools & tackles, P&M, preparation of reports and completion of PUQ system in all respect for Unit 3 & 4 is in the scope of the contractor. Supply & application of intermediate & finish paint will be paid in respective BOQ.
3. Supply & application of Kirloskar Make Polyglass 100 Anti-corrosive coating on inner surface of field joint of PUQ pipe is in the scope of the contractor. Payment will be made in respective BOQ.

### 1.2.12.3 **CS piping for intermediate cooling water supply PGB buried portion (G3):**

The PGB system is meant for circulating DM water through buried piping between pump house UQA and turbine building UMA.

The scope of supply and application of anti-corrosive painting on field joints including rectification in case of damage during shifting is in the scope of contractor. Shifting of pipes from the BHEL stores/painting shop to erection site is in the scope of the contractor.

Note:

1. The excavation of earth and backfilling, sand bedding, sand filling shall be executed by the contractor in separate BOQ item.
2. NDE is part of scope of PGB piping erection work and no separate payment shall be made.
3. Supply of welding electrodes, filler wires & all consumables, scaffolding & platforms, arrangement of man power, tools & tackles, P&M, preparation of reports and completion of PGB system in all respect for Unit 3 & 4 is in the scope of the contractor.
4. Supply & application of Kirloskar Make Polyglass 100 Anti-corrosive coating on inner surface & outer surface of field joint of PGB piping is in the scope of the contractor. Payment will be made in respective BOQ.

### 1.2.12.4 **Piping for potable water supply system GKD in UQA and 1-2 UQC building (G4):**

The GKD system is meant for supply of potable water for cooling of PEC pumps located in UQC building and PCC pumps located in UQA building.

The GKD piping starts from outside the UQA and UQC buildings from

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three different points one for UQA building and two for UQC buildings for each unit. Each pipeline is connected to GKD tanks located in various elevations inside the buildings. 10 Nos of Tank of capacity 180 Liters approx is supplied in fabricated condition by BHEL. Each Dimensions of tank is 800x900x410mm.

NPCIL will hand over constructed floor in UQA & UQC buildings progressively to the contractor with necessary erection of GKD system.

Note:

1. NDE is part of scope of GKD piping erection work and no separate payment shall be made.
2. Supply of welding electrodes, filler wires & all consumables, scaffolding & platforms, arrangement of man power, tools & tackles, P&M, preparation of reports and completion of GKD system in all respect for Unit 3 & 4 is in the scope of the contractor.

### **1.2.13 ERECTION OF CS, SS & HDPE PIPING FOR DRAINAGE SYSTEM GML IN UQA BUILDING (G5):**

Handling, erection, edge preparation, welding and alignment at location, inspection, NDE and hydro testing of GML system as explained in the subsequent clauses. The scope includes arrangement of manpower, tools and tackles, P&M, scaffolding including supply of NPCIL approved electrodes and filler wires & other welding consumables and work completion as per the drawings and approved documents.

The GML system is meant for dewatering from the pits (2 nos.) provided in -7.2 m elevation of UQA building. GML pumps are provided in the pits. The GML system piping consists of CS & SS pipes as well as HDPE pipes. The scope of contractor for execution of GML system piping in UQA building against this item is from the Pump discharge up to wells outside the UQA building including connection of the GML pump to the discharge pipeline by a suitable flexible hoses and fittings.

NPCIL will hand over constructed floor with pit in UQA building progressively to the contractor with necessary erection openings for lowering of GML pipes.

Shifting of pipes from the BHEL stores/painting shop to erection site is in the scope of the contractor.

Note:

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1. NDE is part of scope of GML piping erection work and no separate payment shall be made.
2. Supply of welding electrodes, filler wires & all consumables, scaffolding & platforms, arrangement of man power, tools & tackles, P&M, preparation of reports and completion of GKD system in all respect for Unit 3 & 4 is in the scope of the contractor.

### **1.2.14 HDPE pipe lines for indoor and outdoor (G7):**

The following HDPE piping work shall be executed by the contractor.

The HDPE buried pipelines PCB51BR001, PCB52BR001 are the sea water supply lines from 3UQA building to 05UKD building. The HDPE buried pipelines PCB51BR002, PCB52BR002 are the sea water return lines from 05UKD building to outfall 3UQX. The above four lines are only between 3UQA, 05UKD and 3UQX. PCB24 and PCB34 are the return lines from sea water pump house UQA to outfall UQX of the each unit.

PCB40 is the sea water supply line from each unit of UQA to Chiller building 0UQR. PCB41 is the common return line from chiller building 0UQR to outfall 3UQX.

PCB60 is the sea water filling pipeline connecting from UQA to end of condenser outlet pipelines PAB near to out fall UQX each unit.

PCB61 is the sea water supply pipeline connecting from UQA to turbine building UMA of each unit.

PUA10 is the dewatering pipe line connecting from UQA to fore bay UPU of each unit. The pipeline shall be erected by the contractor in the concrete open trench which will be constructed and released progressively by NPCIL. Contractor shall erect supports for HDPE piping in trenches as per approved drawings. PUN10 is the sea water supply pipeline connecting from each unit of UQA to chlorination plant 0UPK.

PUQ 10-40 (4x4=16) are the sixteen dewatering pipelines connecting from UUP, UUQ vent chambers of UQZ tunnels to outfall UQX of each unit.

PUK system pipeline is to be erected in the UQA building open trench portion which is intended for the rotary screen mesh washing.

PUJ system pipeline is to be erected in the UQA building open trench portion which is intended for the secondary screen flume washing.

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Contractor shall erect supports for HDPE piping for the portions of PUQ HDPE piping in the area of UUP, UUQ and outfall UQX as per the site condition as per approved drawings.

Each of above buried HDPE pipelines will start and terminate with inspection chambers near to the corresponding buildings. The piping from the inspection chambers to the inside the buildings is CS piping which will issued as free issue materials by NPCIL and erected by the contractor. The HDPE pipe and CS pipe will be connected by flanged joints at every starting and terminating points. Fixing of flanges, stub ends, fasteners and gaskets and connections of HDPE and CS pipeline is in the scope of the contractor as part of the HDPE piping work.

1.2.14.1 The work includes shifting, cleaning, handling, welding, joining, fabrication and erection, tightening, visual inspection, testing of HDPE pipelines as mentioned in the erection drawings.

1.2.14.2 Welding of HDPE pipes will be done by contact heating welding method (butt welding method) by using heating plate. For joint preparation, the pipes and fittings are axially aligned and clamped in the welding machine. Welding equipment used for the HDPE pipe fusion welding shall be of manual/hydraulic type. The welding procedure shall be qualified by suitable mock up joints before start of actual job. Providing tapping for vents and drain connections, sampling connection etc., up to and including first isolation valve, Hydro test of HDPE piping, draining & drying with compressed air as required to be carried out. The work includes preparation and submission of procedures for fabrication, erection, welding, arrangement of manpower, consumables, tools, tackles, plant and machinery for completion of the work as per drawings.

The scope also includes supply of RCC pipes and fittings etc confirming to IS 458 as a hume pipe at road crossings or any other area wherever hume pipe is required, laying of RCC pipelines inside trenches, alignment, sealing with cement mortar, curing, making of reports including arrangement of man power, tools & tackles, plant & machinery, consumables, cleaning aids etc and completion of work as per tender specification and drawings.

Tentative size and quantity of Hume pipes are: Hume pipe dia: 650/850 mm approx. Total quantity of Hume pipe is approx. – 250 Running

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Meters. No separate payment shall be made for supply and laying of Hume pipes.

### **1.2.15 BURIED PIPING & EARTH WORK (G8-G10):**

The scope involves fabrication, welding, erection of buried piping work of CS pipes and HDPE pipes. Earthworks like excavation of soft soil, hard rock, sand bedding, sand filling and backfilling and compaction are required to be done by contractor at site for buried piping works.

The scope of work covers excavation of foundations, trenches, pits and over areas, in all sorts of soils, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities if any, such as water lines, electric cables etc., dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, sand bed and sand filling, backfilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth/materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

The contractor shall clear the areas required for the construction and also clear all areas where backfill or grading is specified.

The erection of buried pipelines comprise of excavation of earthwork to the required depth for laying out the pipelines as per drawings / specifications with specified slope. Before excavation the contractor has to take the proper permit from various NPCIL departments, preparation of fine grained sand base 100 mm thick, compaction of the sand base in a thorough manner, welding, inspection, testing, cleaning, grit blasting and painting of the pipe spools, careful lowering of the welded and tested spools over the compacted sand base, positioning, aligning and welding of the pipes and filling the trench with sand gravel mix up to level 200 mm above the top surface of the pipeline layer by layer with careful compaction. After that the trench is to be backfilled with local soft soil. This soft soil will not contain any stones, sharp materials after the completion of pipeline erection; the pipe ends are to be blanked so as to prevent the entry of foreign materials.

#### **1.2.15.1 Excavation of earthwork:**

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This shall consist of all works involved in excavation of earthwork (may be soft soil or hard rock), shoring, filling around foundations, disposal of soils as directed by the EIC for trench work, and arrangement of manpower and machinery required for the successful execution of the work. The soil at work place may be soft or may contain hard rock. The contractor should arrange for all the materials required for carrying out the job. The areas to be excavated shall be clearly demarcated in the field by the contractor. Excavation shall be done to the lines and levels defined in drawings.

The contractor shall notify the EIC before starting excavation and before the ground is disturbed to enable joint measurement of existing levels for the purpose of measurements. The ground levels shall be taken at 5 to 15m intervals in uniformly sloping ground and at closer distance where local mounts, pits or undulations are met with as directed by the EIC. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the EIC, before the earth work is actually started. The instrument, surveyor and labour required for taking levels and plotting of levels shall be supplied by the Contractor at his own cost. All the drafting facility and stationery shall be arranged by the Contractor.

- 1.2.15.1.1 Limits of excavation: Excavation shall be carried out to such widths, lengths, depths and profiles as required for laying the pipe line and specials etc. after obtaining clearance from the EIC. The excavation shall be carried out with special care. Rough excavation shall be carried out to depth 150mm from the final level; soft pockets shall be removed even below the final level and extra excavation to be filled up as directed by the EIC. Should any excavation be carried out beyond the specified limits, the contractor should fill it up with the same type and class of material proposed to be laid over the excavated portions. No payment will to be made to the contractor on this account.
- 1.2.15.1.2 Excavation in open cuts: Suitable berms shall be left at the appropriate places with necessary approach ramps for installation of dewatering pumps or other purposes and where required and / directed by the EIC. These shall be excavated later to the satisfaction of the EIC. No extra payment shall be made for formation of such berms or ramps etc.

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- 1.2.15.1.3     **Stability and safety of excavation:** The methods of excavation shall in every case be subject to the approval of the EIC and the contractor shall ensure the stability and safety of the excavation, adjacent structure services and other works. The sides of the excavation for foundation on structures shall be protected by a proper method approved by the EIC. The contractor shall have full responsibility for the stability of the excavations and safety of workmen. If any slip, occurs, the contractor shall remove all the slipped material from excavated out without payment. Also if any damage to the built up structure occurs because of the slip, the contractor shall make good such damage without any payment.
- 1.2.15.1.4     **Timber shoring:** Timber shoring shall be 'close' type. Timber shoring shall be specified in IS 3764 safety code for deep excavation. The same shall be designed by the contractor and got approved by the EIC prior to its use in the work.
- 1.2.15.1.5     The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started at one end and to proceed systematically to the other end. No part of the work should be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.
- 1.2.15.2        **Sand bedding and sand filling:**  
Sand bed to be made before laying of pipes on the excavated locations. Work includes, supply and filling of crusher sand free from stones, sharp material in to the trenches for sand bedding and sand filling for laying of pipelines for specified depth. Earth shall be filled over the sand filling up to the ground level with required compaction. Work involves loading and unloading, transportation to site, staking, spreading, watering, careful compaction, dressing, removing surplus material, making of reports including arrangement of manpower, P&M, tools & tackles, consumables etc and completion of work as per tender specification and drawings.
- 1.2.15.3        **Back filling & disposal of surplus:**  
Earth material for backfilling shall generally be obtained by selecting from the soil of excavation (after removing the stones and sharp materials).

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Backfilling of soil shall be taken up layer by layer with the layer height not exceeding 150 mm. Adequate watering of each layer shall be done. The back filled soil compaction shall be as good as original earth. All materials, structures, foundations, surface, etc. effected or damaged during excavation shall be made good by the contractor at his own cost.

All surplus materials shall be carried away from the site and dumped at dumping area identified by the EIC which is within the area of the project site. The contractor shall dump the excavated materials in regular heaps, bunds, blankets & level so as to provide natural drainage as directed by the EIC. All such works as mentioned above are deemed to have been taken into account while quoting for this work and not extra shall be payable to the contractor for the works.

The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labour, materials etc. to complete all the operations specified. Rates of sand bed includes cost of compaction, cost of crusher sand, transportation, watering, sand bedding, filling, the mode of measurement in cubic meter. Rate of Backfilling includes consolidation of back filled earth. The rates quoted for excavation and back filling shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill. The rates for terms shall include dressing the base and consolidation of same, supply, stacking, conveying to work site, laying, watering, rolling, finishing etc. of murrum including all labour, tools and plants required for the work.

1.2.15.4

**Inspection chamber construction (G11):**

HDPE buried pipelines are to be connected to CS pipelines coming out of the building by means of flanged joints. For accessibility of flanged joints during future maintenance work, the contractor shall design and construct approximately 20 nos. of inspection chambers in the locations of flanged connection for both the units. The total RCC quantity

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required for construction of such inspection chambers is approximately 200 cub. m. The scope of work involves providing and laying RCC of 1:2:4 using machine crushed max 20 mm downgraded stone aggregate, reinforcement steel with strength M40 W80 and as specified in manufacturer drawing and specification. Mechanical mixing, conveying, ramming, compacting, leveling, finishing, curing, reinforcement work, shuttering/ dismantling, scaffolding etc including all materials, consumables, tools & tackles, equipments, manpower complete as per drawings and specifications and instructions of EIC. Contractor shall design, supply and install suitable manhole cover on top and ladder inside the constructed inspection chambers for accessibility. Water proofing is also to be done by providing bituminous coating and mat. Steel re-bars shall be of High strength deformed steel bars (HSD) of grade Fe 500D (TMT) conforming to IS: 1786 and testing of reinforcement bars shall conform to provisions of IS: 1608. 16 gauge SWG wire shall be used for binding reinforcement bars. The bottom of the inspection chamber and the grade level are as per the drawings. After completion of construction of inspection chambers in all respects, water fill test shall be carried out by contractor before backfilling around the chambers.

### **1.2.16 STRUCTURAL STEEL WORKS (SCHEDULE -H)**

#### **1.2.16.1 Fabrication and erection of structural steel: (Structural steel shall be supplied by BHEL as Free issue)**

1.2.16.1.1 The work includes fabrication and erection of all structural works like Platforms, handrails, gratings, ladder, pipe and equipment support structures, saddles and clamps, support brackets for material handling equipments, safety cover plates, cross-over staircases/platforms, anchor/EP (Embedded Part) plates and other structural items including chipping and leveling of concrete wherever required.

1.2.16.1.2 Preparation of structural fabrication and erection detailed drawings & procedures and get approval from BHEL & NPCIL before starting the fabrication.

1.2.16.1.3 All structural members should be grit blasted and painted through separate BOQ item.

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- 1.2.16.1.4 Work of fabrication as per approved drawings includes, handling, transportation, storage, drilling, bending, straightening, cutting, bolting, welding, grinding, erection, fixing and aligning in line and level.
- 1.2.16.1.5 Arrangement of required man power, tools & tackles, plant & machinery, special tools, cleaning aids, scaffolding etc, supply of consumables including NPCIL approved electrodes and filler wires to complete the work as per drawings.
- 1.2.16.1.6 Inspection, testing and making arrangements for the acceptance of the structures by NPCIL, preparation of reports, documents required at various stages of the work.
- 1.2.16.1.7 The Contractor may note that embedded plates/fasteners are provided in the floors and walls for fastening the structures to the floors, ceilings and walls.
- 1.2.16.1.8 In case of non availability of EP's, the contractor install the anchor fasteners through separate BOQ item. Anchor Fasteners shall be supplied by BHEL as free issue.
- 1.2.16.2 **General practice in structural steel works:**

The following are the general practice followed in the fabrication and erection of structural steel works.
- 1.2.16.2.1 The contractor shall submit the procedures and get it approved well in advance but before the start of the work.
- 1.2.16.2.2 Unless specified in the relevant drawing and specification, all erection work shall be carried out in accordance with the latest edition of Standard code of practice for use of structural steel in General building construction SNiP-II-23-81/ IS:800.
- 1.2.16.2.3 Tolerances: Standard tolerances as per relevant specifications/ drawing shall be followed.
- 1.2.16.2.4 Cutting may be done by shearing, sawing or machine flame cutting. All re-entrant corners shall be shaped notch free. Sheared or gas cut edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.
- 1.2.16.2.5 Hand flame cutting shall be undertaken only if so permitted by the EIC and shall only be carried out by an expert in such work. Hand flame cut edges shall be ground smooth and straight.

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- 1.2.16.2.6 All the fabricated embedded parts of Structural Steel members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment and surface finish in accordance with the requirements shown on the Contractor's shop drawings approved by NPCIL and/or Engineer's drawings.
- 1.2.16.2.7 In case of any faulty erection, all such dismantling and re-erection required will be at the Contractor's cost. Erection in general shall conform to the relevant clauses in IS: 800.
- 1.2.16.2.8 No dragging of fabricated anchor plate is permitted.
- 1.2.16.2.9 The Contractor shall protect all existing plants, embedded parts, all permanent and temporary structures, piping, conduits, equipment and facilities against damage during erection. The Contractor shall perform his work in a manner, in no way endangers the operations of any existing plant or structures or hinders other construction activities.
- 1.2.16.2.10 The Contractor shall be responsible for all transportation, loading and unloading for erection equipment and material to and from site.
- 1.2.16.2.11 Any rework / rectification required on the place of erection (floor / wall / roof EP's) are to be carried out by the Contractor for proper placement of fabricated plates to the satisfaction of the EIC by chipping and additional EPs /plate provided with proper approval issued by EIC. Under any circumstances no flame/gas cutting is permitted for making hole in structural works at site. This shall also include any additional inspection requirements as decided by the EIC.
- 1.2.16.2.12 All the erected structures, assembly and welding executed in accordance with the WD requirements are to be checked and offered for inspection by NPCIL Engineer and recorded in a protocol.
- 1.2.16.2.13 The works shall be executed as per the WD's, approved procedures and to the Instructions of EIC.
- 1.2.16.3 **ISSUE & ACCOUNTING OF STRUCTURAL MATERIALS:**
- (i) Structural Steel will be issued from BHEL stores on weightment basis (MT). The steel issued to the contractor shall be mainly in standard length and sections as received from the supplier. However, the contractor shall be bound to accept the steel in length as available in the project stores. No claims for extra payment because of issue of non-standard length will be entertained.

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- (ii) The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.
- (iii) The contractor shall submit to the engineer, a statement indicating estimated quantity of structural steel required during a quarter, at least two months in advance of the quarter based on final detailed drawings approved by BHEL & NPCIL. In addition, the contractor shall also furnish the estimated requirement of structural steel during a month by the third week of the previous month indicating his requirement.

### 1.2.16.3.1 **RETURN OF MATERIALS**

- (i) All surplus steel and all wastage materials will be taken back on weighment basis. Surplus, unused and untampered steel shall be sorted section-wise and returned separately to BHEL stores. Return of such materials will not be entitled to any handling and incidental charges.
- (ii) All wastage / scrap (including melting scrap, wastage, un usable scrap) shall be promptly returned to the stores and a receipt obtained for material accounting purposes. Return of such material will not be entitled to any transportation and incidental charge.

### 1.2.16.3.2 **SCRAP & SERVICEABLE MATERIALS**

- (i) All Structural steel of length above 2 M except M.S. Plate shall be considered as serviceable materials provided the materials is in good and acceptable condition. Structural steel in length less than 2 M shall be treated as scrap.
- (ii) Plates having both sides greater than 1 Meter or if any side is less than 1 M but greater than 0.5 M and the total area is equal or greater than 2 Sq. Metre shall be considered as serviceable.
- (iii) All pipes measuring 2 M and above in length shall be treated as serviceable materials provided they are in good and acceptable condition. Pipe in less than 2 M length shall be treated as scrap.

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### 1.2.16.3.3 WASTAGE ALLOWANCE

#### STRUCTURAL STEEL, (ROLLED SECTION, PLATES ETC.) CONSUMPTION & WASTAGE.

##### a) CONSUMPTION

The theoretical consumption of various sections shall be based on approved drawings. Weights shall be calculated considering the sectional weights as per Indian standard. No extra shall payable to the contractor for any deviation in weights for the two different procedures adopted for issue and calculation of the theoretical consumption including rolling tolerances.

- i. Actual consumption = Issue – Surplus.
- ii. Surplus = Un-tampered & unused quantity of steel and Serviceable materials as stipulated under clause “Scrap and Serviceable Materials (**Refer Clause 16.3.2 above**)” returned by the contractor to BHEL store along with relevant documents.
- iii. Wastage = Actual consumption – Theoretical consumption.

##### b) WASTAGE

Allowable wastage: +4% (FOUR percent) of the theoretical consumption shall be considered. Wastage shall be considered as cut pieces and scrap material, measured as per actual weighment basis. Invisible wastage (max limit to 0.5%), if any, shall be considered to be included in the specified 4 % allowable wastage.

Sl.no	CONSUMPTION OF STRUCTURAL STEEL (ROLLED SECTION, PLATES, SS LINER & RECOVERY)	BASIS OF ISSUE & RECOVERY
S1	Theoretical consumption (without Considering any wastage, scrap or loss) as per spec. & drg.	Free
S2	Wastage limited to plus Four percent (+4%) of the aforesaid theoretical consumption (S-1) towards allowable wastage including invisible wastages	Free

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	(invisible wastages limited to 0.5% of theoretical consumptions).	
S3	Wastage beyond Four percent (+4%) of the aforesaid theoretical consumption (S-1).	Penal Rate

### 1.2.16.3.4 RECONCILIATION OF MATERIALS

- i. The contractor shall submit a reconciliation statement of steel issued to him with each RA Bill.
- ii. At the time of submission of bills, the contractor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with contractor's custody at site.
- iii. At the time of submission of bills by the contractor, if it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then, BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified.
- iv. The reference drawings for actual material consumption to be used for the purpose of reconciliation shall be drawings prepared by the BHEL and drawings approved by BHEL for fabrication works and such other drawings approved by BHEL.

### 1.2.16.3.5 RECOVERY OF MATERIAL

Recovery of wastages shall be made from the bills of contractor at the penal rate mentioned in the table below for the following cases:

- a) If wastage exceeds the specified limit, the recovery of excess wastage shall be made from monthly R/A Bill at the Penal Rate.
- b) If the wastage not exceeded specified limit, but not returned to BHEL store except invisible wastage
- c) For not returning the surplus serviceable materials

PENAL RATE OF STRUCTURAL STEEL MATERIALS (MS plates, MS flats, rolled steel joists, channels, and angles, MS pipes, Chequered Plates, etc in sizes and lengths as available) shall be Rs. 82,320/- per MT + GST and/or other taxes & duties.

### 1.2.16.4 Fixing of Hilti fasteners: (Anchor Fasteners shall be supplied by BHEL as free issue)

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Wherever EP's are not provided, the contractor shall fix the anchor fasteners. The anchor fasteners are to be fixed on concrete wall, floor or ceiling at different locations and buildings to fix the EP and provide support to pipe, equipment and structural members.

Scope includes Marking of holes, drilling of concrete to depth specified in drawing, cleaning the holes and anchor fasteners to be fixed using fixing tool and tightened to the required torque as per the manufacturer's catalogue. All consumables, machineries, power supply, approach platforms, scaffolding, tools and tackles and works required for completion is in the scope of contractor, extra holes have to be drilled if any obstruction of reinforcement rods occurs in the location. Unused holes shall be filled with dry pack material, Core drilling using diamond core drill bit on wall/floor/ceiling shall be performed as required with the approval of EIC. Scope includes supply of all consumables including diamond core drill bits.

### **1.2.17 GRIT BLASTING AND PAINTING WORKS (SCHEDULE -I):**

Grit blasting, primer application & painting has to be performed for the various process system pipe lines, fittings, supports, structural items and other surfaces as mentioned in the working drawings. Pipes and structures shall be cleaned, de-burred, milled scale, oil if any are to be removed before grit blasting. Material shall be inspected for any damage, lamination etc.

Contractor Scope of work includes, supply of NPCIL approved primer, paints and thinner with test certificates, all tools, shots & grits, blasting equipments & air compressors, mechanical mixer, spray guns, hand power tools and all equipments, scaffolding materials, brushes, rollers, accessories and consumables, lighting arrangements, personal protection equipment etc. required for the completion of work, submission of work procedures, Quality Assurance Plan (QAP), Job Hazard Analysis (JHA), and other mandatory documents to NPCIL for acceptance, qualification of grit blasting, grit blaster, paint application process, applicator and procedures at site, testing of sample coupons, arrangement of all measuring and testing tools, testing equipments, testing kits, surface comparators, Press - O film, wet film gauge, digital Elcometer etc, arrangement of suitable and clean

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storage area, Grit blasting, paint mixing/application workshop, and good office etc. with proper ventilation, exhaust fans, fire extinguishers for fire hazards, carrying out grit blasting and paint application, conducting various tests on the painted surfaces to identify defects and organizing the inspection of painting and testing by BHEL/NPCIL representative and obtaining their approval, repair of the defects any observed and bringing it to acceptable conditions, handling of material at painting shop or at field, shifting of painted material to field and shifting to final erection point, preparation and submission of all relevant documents to BHEL/NPCIL after completion of painting.

### **1.2.18 ANTI CORROSIVE PAINTING FOR SEAWATER SYSTEMS (SCHEDULE-K )**

Contractor shall supply and carryout application of anticorrosive painting on field joints of CS pipelines inner and outer surfaces.

The scope of work includes:

Supply of all painting material and consumables as specified for painting work as per the Technical specification no I02.KK34.0.0.TH.TS.PR009(R01) and application of anti-corrosive coating.

1. Surface preparation and application of anti-corrosive coating on field joints.
2. All coating shall be done on clean, rust/scale free and dry surface after surface preparation and shall be fairly uniform.
3. Preparation and submission of coating procedure for approval of the EIC before taking up any coating work.
4. Shifting of painted pipes to various locations of erection site. Contractor shall handle the painted pipes carefully by using nylon webbing slings/ rubber pads, etc not to cause any damage to painted surface. Care shall be taken during all stages like storage (stacking), handling, shifting, and erection at site not to cause any damage to painted surface. Weld profile shall be prepared suitable for application of coating and painting.
5. Contractor shall conduct inspection & tests on the painted pipes as per the technical specifications and prepare reports after acceptance by NPCIL.

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## **1.2.19 MISCELLANEOUS WORKS (SCHEDULE-L):**

### **1.2.19.1 Chipping of concrete (L2):**

Work front will be released to contractor for the erection of equipment and pipeline. Contractor shall survey the work front and make arrangements by levelling and finishing the area for starting the erection work. During such arrangement in case of any requirement of concrete chipping contractor shall bring to notice of EIC and get clearance for carrying out the chipping work. The scope involves identification, marking, mounting & setting up of machine for chipping of concrete as required, disposal of debris, preparation of reports, arrangement of man power, tools & tackles, plant & machinery, consumables, cleaning aids etc, as per drawings, documents and specifications with acceptance of EIC.

### **1.2.19.2 Concrete core cutting (L7):**

Wherever penetrations are not available on concrete wall, floor or ceiling but required as per the drawings, contractor shall carryout concrete core cutting operation to continue with the further erection work with approval of EIC. The scope includes marking of holes, drilling and core cutting of concrete to the required depth, cleaning of the hole and disposing of cut pieces to identified location including P&M, drill or core cut tools, all consumables, manpower, power supply, approach platforms, scaffoldings, tools and tackles required for completion.

### **1.2.19.3 Manpower assistance for repair, preservation and pre-handing over checks, supply of preservation consumables and scaffolding (L8):**

#### **1.2.19.3.1 Repair work:**

Contractor shall provide manpower assistance to BHEL/NPCIL's in-case of any requirement of major repair of free issue materials at site (including NPCIL & BHEL/contractor stores). Contractor shall engage skilled/semi skilled/un-skilled workers along with the necessary machinery, tools & tackles, lighting arrangements, cables, extension boards, general consumables, cleaning aids and applicable PPE's required for carrying out such repair works. The manpower will be assessed by EIC or his representative before engaging them in

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work. The deployment of personnel, deployment schedule and duration of work shall be as per the requirements and as instructed by the EIC. Contractor shall obtain necessary permits & clearances as per the prevailing guidelines at the project. Contractor shall prepare report for completion of work and it will be certified by the EIC or his representative.

The repair work shall be like repair of deformed structure/components and restoring to original shape by bend removal, straightening (with or without the application of heat), deformation correction etc., preparation of reports and work completion as per the instructions of the EIC.

Carrying out such repair activities by the one labour in a day (8 hrs.) along with general consumables like wire brush, lint free cloth, emery etc and P&M for heating and bend removal, general tool kit will be treated as one operation day.

### 1.2.19.3.2 **Preservation works:**

On receipt and erection of items, the first preservation shall be carried out by contractor within the part of scope of erection. Subsequently the items shall be kept in preserved conditions by contractor during the entire contract period.

The scope of the contractor for subsequent preservation is to carry out de-preservation and preservation works for all the piping, equipments and components stored at contractor's stores and those erected at site during the entire period of contract depending upon the requirements as and when the equipments become due for preservation/de-preservation and as directed by the EIC. Contractor shall engage skilled/semi skilled/un-skilled workers along with general consumables like wire brush, lint free cloth, emery etc and general tool kit, the necessary tools & tackles, lighting arrangements, cables, extension boards and applicable PPE's required for carrying out such preservation/de-preservation activities.

Carrying out such preservation activities by the one labour in a day (8 hrs.) will be treated as one operation day. The manpower will be assessed by EIC or his representative before engaging them in work. The preservation work shall be carried-out as per the procedures provided by NPCIL.

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### 1.2.19.3.3 **Man power assistance during system pre-handing over checks:**

Contractor shall provide manpower assistance to NPCIL's for system pre handing over checks by engaging skilled/semi skilled/un-skilled workers along with the necessary machinery, tools & tackles, lighting arrangements, cables and extension boards. The manpower will be assessed by EIC or his representative before engaging them in work.

Pre handing over checks involves activities such as cleaning and box-up of oil tanks, shifting of materials for supporting activities, filling/draining of fresh/used oil after flushing, bolt tightening, strainer/filter cleaning, valve internal removal and box-up, valve opening/closing, gasket replacement, greasing, support spring measurements & adjustment of charged and hot systems, etc, preparation of reports as per the instructions of the EIC.

Carrying out such pre-handing activities by the one labour in a day (8 hrs.) along with general consumables like wire brush, lint free cloth, emery etc and general tool kit will be treated as one operation day.

### 1.2.20 **QUALITY ASSURANCE & TESTING:**

#### 1.2.20.1 **General requirements**

1.2.20.1.1 The work under this contract/package covers seawater and associated 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 states of procurement, handling, storage, cleaning, pre-fabrication, erection, inspection and testing of equipments and piping.

1.2.20.1.2 Notwithstanding with the quality control requirement given in referred normative document /specification, the following shall be applicable during the quality assurance & testing.

- a. Certification of inspectors;
- b. Inspection of fit-up and welding and thermal equipment;
- c. Incoming control of main materials;
- d. Quality control of welding materials;
- e. Operational and process control;
- f. Non-destructive inspection;
- g. Destructive inspection;
- h. Hydraulic and pneumatic tests

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- 1.2.20.1.3 Contractor shall prepare QAP for all the erection activities at site and submit for approval of NPCIL. The operational control includes inspection of technology compliance in the course of preparation of details, fit-up, heating, welding process etc
- 1.2.20.1.4 The equipment and pipeline erection covered by this contract shall be subjected to stage inspection and final inspection and testing as per approved QAP. The Contractor shall provide all required services and resources to establish and maintain quality of workmanship during erection.
- 1.2.20.1.5 All equipment and consumables for destructive/non-destructive testing, examination & inspection, temporary arrangements & provisions for pressure & leak testing, facilities for clean shop with air washing and filtration facilities, detergent wash of SS pipes and cleaning of the pipelines including consumables supplies for the same and the facilities such as filtered water, oil free compressed air unit.
- 1.2.20.1.6 The contractor shall perform his internal inspection / testing before offering the system for BHEL/NPCIL's inspection. Only after ensuring that his inspection/test results are satisfactory, contractor shall offer the system for BHEL/NPCIL's inspection.
- 1.2.20.1.7 All equipment and pipeline erected shall be checked for proper alignment, orientation, bolting/ welding etc. The inspection requirement depends upon the safety class and group of particular codes and standards.
- 1.2.20.1.8 Along with the main control methods some complementary control methods are also possible (styloscope method, hardness measurement, etching etc.).
- 1.2.20.1.9 Destructive examinations such as mechanical test, IGC test, metallographic analysis, determination of chemical composition, and determination of ferritic phase shall also be carried out to ascertain the quality of the weld and base.
- 1.2.20.1.10 The inspection requirements will be indicated in detail in the working drawing and specifications.
- 1.2.20.1.11 Contractor shall not undertake any pre-fabrication job outside the Project area unless otherwise it is permitted by the EIC. All items fabricated outside the Project and all materials to be supplied by the Contractor are subject to EIC's Quality Surveillance.

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- 1.2.20.1.12 During work the Contractor must keep records on certification of personnel, material control, operational control, acceptance control. Record formats must be unified, and should be prepared before start of work.
- 1.2.20.1.13 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, erection and testing work at site.
- 1.2.20.1.14 NPCIL/BHEL shall carry out audit in all phases of the work i.e. procurement, pre- fabrication, erection, inspection, examination and testing.
- 1.2.20.1.15 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. This includes access necessary to verify the implementation of all aspects of the Quality Assurance Program as well as access to Sub-contractor's facilities.

### **1.2.21 FOREIGN MATERIALS EXCLUSION (FME):**

Proper FME control procedure shall be exercised during the course of erection for equipments as well as piping. During all stages of assembly & erection of equipment and piping, contractor shall maintain utmost care and ensure that no Foreign Material is trapped or locked inside the equipment or piping. It is the responsibility of the contractor to establish proper entry and working procedures at site such as providing proper lockers, preventing the workers from carrying any loose items, training the workers on FME etc. Any damage to the equipment or component due the foreign material inclusion shall be at the cost of the Contractor.

In addition to the requirements of specification, clean environment/shop conditions shall be maintained at site. Internal surfaces of the pipe line shall be cleaned with rotary brush and air and inspected for foreign material before taking up pre- fabrication. All machined surfaces shall be protected from dirt and mechanical damage. All threaded connections shall be either capped or have thread plugs inserted until the

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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 EIC.

Note: No additional cost will be paid for FME inspection and is included as a part of equipment and pipeline erection and inspection works.

### **1.2.22 HOUSEKEEPING, CLEANLINESS & DEWATERING:**

Contractor shall keep the area clean and materials segregated neatly in coordination with other contractors. The scraps and wooden boxes shall be cleared from the working areas. When work is going on, it is the responsibility of the contractor to maintain clean environment by maintaining good housekeeping.

The contractor shall thoroughly check and remove the extraneous materials, if any, like electrodes, welding rods, helmets, bolts/nuts, etc. left behind in the pipelines. All erected piping shall be cleaned from inside before testing and making the closure joints. The contractor shall engage adequate cleaning personnel with machinery such as vacuum cleaner for cleaning. Cleaning shall be done on day to day basis. All the waste collected shall be stored in sealed container and to be removed on weekly basis. All wastes generated like surplus earth after use/surplus construction materials to be disposed off from time to time to the disposal locations as directed by the site EIC.

Handling, Shifting & disposal of the waste generated during construction, installation, etc shall be a part of the contractor's scope of work. Contractor to collect such waste generated within battery limit and then transport and dispose to the locations as directed by the site EIC. Also, housekeeping and dewatering of the area under the control of the contractor shall be a part of the contractor's scope of work.

#### **1.2.22.1 Debris Disposal:**

Involves Collection of debris from various floors of buildings, shifting and disposal to waste yard which includes activities like survey of the buildings, identification, collection and removal of dust, electrode waste, welding waste, cutting waste, grinding waste, packing material, cement debris, aggregate, waste sheets, cut pieces of wires/cable etc. from inside and outside of buildings and disposal at designated dump yard.

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This work also includes providing man power, P&M, all tools & tackles required for completion of work, making & maintenance of reports as per tender specification and as per the instructions of the EIC.

### 1.2.22.2 **Scrap Disposal:**

Involves collection of scrap (metal & wooden) from various floors of buildings, shifting and disposal to waste yard which includes activities like survey of the buildings, identification, collection, segregation of SS, CS, wood, paint, insulation, concrete and removal of metal scrap, cut pieces, wooden scrap, woods etc. from inside and outside of buildings and disposal at waste yard. This work also includes providing man power, P&M, all tools & tackles required for completion of work, making & maintenance of reports as per tender specification and as per the instructions of the EIC.

### 1.2.22.3 **Surface Cleaning of equipments and pipeline:**

Involves cleaning of external surfaces of all equipments, pipelines & valves etc in all the floors of buildings which includes activities like removal of dust, unwanted sticking, foreign particles and other forms of dust, from the surface of equipment, pipelines, valves etc including providing all necessary cleaning aids and appliances. This work also includes arranging manpower, consumables and all other required tools and tackles required for the completion of work as per tender specification and as per the instructions of the EIC.

### 1.2.22.4 **Sweeping & Mopping:**

Involves Sweeping and mopping of all the floors and stair cases of buildings including providing all necessary cleaning aids like brooms, duster, buckets, collecting trays or any other appliances as directed from time to time for the satisfactory execution of above mentioned work. This work also includes arranging manpower, consumables and all other required tools and tackles required for the completion of work as per tender specification and as per the instructions of the EIC.

### 1.2.22.5 **Dewatering:**

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In order to keep continuity of the work contractor shall carry out the dewatering in various buildings under this contract to remove the accumulated water and pump the water to the designated wells or locations as instructed by the Engineer in Charge (EIC). The arrangement of dewatering pump and required connecting hoses, manpower and all other required tools and tackles are in contractor's scope. During excavation, dewatering with well points and / or deep tube wells at foundations and other areas of the site is not permitted where a build-up in the opinion of the EIC obstructs the progress of work, leads to unsanitary conditions by stagnation, retards the speed of construction, is detrimental to the safety of men, materials, structures, equipment and such other causes.

The contractor shall ensure that the excavated areas and the structure pipes are free from water at all stages of construction and shall take all necessary precautions and measures to exclude ground water and water from other sources such as underground streams, aqua forms, springs, artesian, precipitate or infiltrations from the surface flows water drained during and after hydro test etc. so as to enable the work etc. be carried out in reasonably dry condition in accordance with the specifications and the construction schedule

Note: Housekeeping and dewatering is part of scope of work and no additional cost will be paid. It is the responsibility of the contractor to ensure good housekeeping failing of which penalty as applicable will be levied.

### **1.2.23 GENERAL TECHNICAL REQUIREMENTS:**

The general technical requirements are based on norms, standards and practices followed for such jobs. The EIC shall have the right to amend the existing and to issue additional specifications whenever the need arises. In the event that certain technical requirements are not described in the engineer's specification, the contractor shall request the EIC, prior to starting any fabrication to clarify governing requirements.

#### **1.2.23.1 Threading:**

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The contractor shall be responsible for threading all mating components to suit the threads on valves, pipe fittings and equipment flange bolting, studs, nuts and mounting bases being supplied by the EIC.

Matching threads of hanger components supplied or fabricated by the contractor may be threaded to any commonly accepted standard unless otherwise specified on drawings; however the same thread standard must be used throughout and shall be subjected to the approval of EIC. The threads shall be cut with a sharp and properly adjusted threading tool to the correct taper and lead. Improperly made threads of any discrepancy shall be cut from the pipe and new threads made to the satisfaction of the EIC. Threads shall be concentric with the outside barrel of the pipe. Pipe thread diameters shall be such as to allow sufficient hand engagement and yet allow enough threads for wrench-up to produce a tight joint. All pipe threads shall be cut on machine only and shall be checked with approved gauges.

Prior to making a screwed joint, the threads shall be thoroughly cleaned of all foreign matter, oil, grease etc. Any thread that has become blurred or deformed shall be repaired using suitable standard and size tap set and die set prior to assembling the joint. If the thread is damaged to the extent that it cannot be repaired without sacrificing the tightness of the joint, then the threaded end shall be cut out from the pipe and new threads made to the satisfaction of the quality surveyor. No lubricants or sealants shall be used on threaded joints of any pipes carrying water, gas.

### 1.2.23.2 **Tightening of bolts:**

All bolts and nuts shall be installed properly. At least two threads on bolt should project beyond nut. In bolting of flanged joints with gasket, the contact faces of the flanges shall bear uniformly on the gasket, and the gasket shall be properly compressed in accordance with the design principles applicable to the type of gasket used. The bolt stress in all flanged joints shall be relatively uniform. 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. Torque Wrenches 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 in drawings.

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### 1.2.24

#### **SCAFFOLDING:**

It is the responsibility of the contractor to arrange for scaffolding materials, making, assembly and dismantling at his own cost where ever work at height is involved as part of his scope of work. The contractor has to arrange the necessary scaffold pipes/H-frames, clamps, platforms, mesh, footings, guard rails and all such material required for the construction of scaffolding. Only standard scaffolding materials and platforms are allowed for use to work at height. Each scaffold and scaffold component must support without failure its own weight and at least four times the maximum intended load applied or transmitted to it. Utmost care must be taken while making the scaffolding and it is the duty of the contractor to construct & maintain healthy scaffoldings with guard rails, fall arrestors, cross bracings, footings, platforms etc during the progress of work. The structural members, poles, legs, posts, frames, and uprights, must be plumb and braced to prevent swaying and displacement. All the scaffolding works need to be supervised by an expert who is familiar with the scaffolding requirements and its shortcomings. The contractor has to display placards on all the scaffoldings indicating the condition of the scaffold. Before the actual use of scaffolding, contractor has to arrange for the inspection of the scaffoldings and get clearance from the concerned NPCIL officials as per the procedures laid down at the site. Contractor shall ensure that all his contract workers are trained by a qualified person, to recognize the hazards associated with the type of scaffold being used and how to control or minimize those hazards. The training must include fall hazards, falling object hazards, electrical hazards, proper use of the scaffold, and handling of materials.

### 1.2.25

#### **RECORDS AND REPORTS:**

#### 1.2.25.1

##### **Records:**

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 EIC. The Contractor shall submit the copies of such-records to the EIC within 7 days from

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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 EIC pertaining to the origin and specification of material. The EIC shall need certain records for verification viz. weld inspection report, stress relieving report, consumable certificate, etc. The Contractor will have a system of record to facilitate easy traceability of all such records.

These records shall be subjected to the inspection of engineers, auditing group, AERB, Russian representatives etc. Soft (scanned) copies for the all the reports, records shall be made and submitted to BHEL/NPCIL.

1.2.25.2

### **Reports:**

The contractor shall submit on weekly basis, to the EIC three (3) copies of following reports indicating the details like system wise progress, fabrication/erection progress, system testing status, QA activities, etc.

- a. Piping erection, NDT and testing progress reports
- b. General statement of activities
- c. Welders performance & qualification records
- d. Weekly report on items on critical paths

In addition to above, the following reports shall be submitted to the EIC every month:

- i. Daily, weekly, fortnightly and monthly progress reports
- ii. Monthly planning report
- iii. Three and Six months rolling schedules

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

1.2.26

### **COMPLETION OF WORK AND SUBMISSION OF CCC & MATERIAL ACCOUNTING:**

1.2.26.1

#### **Completion of work:**

As far as technical requirements are concerned, the contractor's work shall be considered completed when the piping systems are installed, painted and have passed all examinations, inspections and test requirements and complete in all respects in accordance with drawings and specifications. The contractor shall be responsible for

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rectifying the defects and deficiencies revealed during testing or commissioning of the systems, on the joints, lines completed, in consultation with the EIC and QS so as not to delay other works or testing.

### 1.2.26.2 **Construction Completion Certificate (CCC):**

The contractor shall submit CCC in hard binder enclosing the relevant documents needed for attesting the completion of work for each system in the approved format for verification and acceptance of ENC. Along with the hard copy of final CCC the contractor shall submit scanned copy in soft form (.pdf format). The following are the list of relevant documents but not limited to.

1. System descriptions
2. Manufacturers instruction / literature
3. As-built drawing information
4. Important correspondence
5. List of WD (with rev. no.) including FCN, ECN & DCN, certified
6. Systems process flow sheets & hook-up joint(s) details
7. Weld inspection reports & radiographic test final results
8. Weld procedures (welding and fabrication procedures, WPS & PQR)
9. Erection procedures for mechanical components (including forming and assembly procedures)
10. Hydro-test results (including pneumatic)
11. Pipe line erection reports
12. Valve erection/testing reports
13. Mechanical joint inspection report [blasting / painting]
14. Test Certificate from manufacturers for all the materials supplied by the contractor.
15. Reports generated during manufacturing, fabrication, erection and testing.
16. Inspection/test report/investigation, field tests, concreting reports etc.
17. Drawings/ documents/ reports relevant to the works.
18. All statutory clearances

CCC documents as detailed above in soft form shall also require to be maintained on regular basis along with progress of the work. The

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completed files along with soft copy shall be subjected to verification by EIC and periodic audit (6 months) by a committee constituted by NPCIL. After all the above information are compiled, verified by the EIC and certified for submission, the 'Construction Completion Certificate' and 'System Transfer from Construction to Commissioning' in the prescribed format along with the System /Equipment History Docket shall be transferred for NPCIL records and reference. Final completion certificate will be issued only after the ENC has accepted all CCC's and after other provisions of general contract conditions are duly met. Along with the hard copy of final CCC the contractor shall submit scanned copy in soft form (.pdf format). The cost towards preparation of CCC is deemed to be included in the quoted rates.

### 1.2.26.3 **Material accounting:**

Contractor shall establish all necessary infrastructures (computer terminals, network, and other hardware) for software based material management system for the free issue materials, compatible with the BHEL/NPCIL's software. Contractor shall prepare material accounting taking into the consideration of materials issued through various CIV, consumed through various erection reports, returned back to BHEL/NPCIL's stores through CCV and tally the quantities and submit to BHEL/NPCIL for acceptance. For this purpose, during execution of work, the contractor shall ensure that the erection reports are prepared as instructed by BHEL/NPCIL.

Along with the hard copy of material accounting statement, the contractor shall submit soft copy in MS excel format and scanned copy in .pdf format.

# TECHNICAL CONDITIONS OF CONTRACT

## Annexure - I

### List of Abbreviations

AC	Alternating Current
AERB	Atomic Energy Regulatory Board
AFWP	Auxiliary Feed water Pump
BDBA	Beyond Design Basis Accidents
BM/BOM	Bill of material
BRU-K	Fast acting steam dump system with discharge into the turbine condenser (FSDV –C)
BRU-A	Fast acting steam dump system with discharge into atmosphere (FSDV – A)
BRU-D	Fast acting steam dump system with discharge into De-aerator (FSDV – D)
CCC	Construction Completion Certificate
CCR	Central Control Room
CCV	Contractor's Credit Voucher
CCW	Condenser Cooling Water
CEA	Central Electricity Authority
CEP	Condensate Extraction Pump
CIV	Contractor's Issue Voucher
CRR	Circuit Release Report
C&MM	Contracts and Material Management
CoManas	Corporate Management System
CS	Carbon Steel
DCN/ECN/FCN	Design Change Notice/ Engineering Change Notice /Field Change Notice
DD	Detailed Drawing
DM	Demineralized Water
DPR	Detailed Project Report
DPT	Dye Penetrant Testing
DBA	Design Basis Accidents
DC	Direct Current
DFT	Dry Film Thickness
DN	Nominal Dia
EIC / ENC	Engineer In-charge

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EP	Embedded part
EPGS	Electronic Part of the Governing System
EDFWP	Electric Drive of the Feed Water Pump
EOT	Electric Overhead Travelling
FAR	Flange Alignment Report
FIM	Free Issue Material
FME	Foreign Material Exclusion
FS	Flow Sheets
GCC	General Conditions of Contract
GSC	Gland steam condenser
GAN	GOSTATOMNADZOR – Russian Regulatory Board
GOST	Russian National Standard
GA	General Arrangement
GTAW	Gas Tungsten Arc Welding
HDPE	High Density Poly Ethylene
HPC/HPR	High Pressure Cylinder/High Pressure Rotor
HPH	High Pressure Heater
HTS	Hydro Technical Structure
HV	High Voltage
I & C	Instrumentation and Control
ID	Inner Dia
IR	Insulation Resistance
IBA	Integrated Business Application
IBR	Indian Boiler Regulatory
IGC	Inter Granular Corrosion
IPMIS	Integrated Project Management & Information System
IMIR	Incoming Material Inspection Report
JIT	Joint Inspection Team
JHA	Job Hazard Analysis
LPC/LPR	Low Pressure Cylinder/Low Pressure Rotor
LPH	Low Pressure Heater
KKNPP	Kudankulam Nuclear Power Project
KKS	KRAFTWERK KENNEZEICHEN SYSTEM (Codification system followed by Russian for identification of buildings, equipments, structures)

# TECHNICAL CONDITIONS OF CONTRACT

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	materials and systems etc. in nuclear power plant)
KLT	Kerosene Leak Test
KV	Kilo-Volt
MDR	Major District Road
MIV	Material Issue Voucher
MCV	Material Credit Voucher
MSR	Moisture Separator Reheater
MT	Metric Tonne
MWe	Megawatt electrical
NDE/NDT	Non Destructive Examination/Testing
NPCIL	Nuclear Power Corporation of India Limited
NTD	Normative technical documentation (Russian standards)
NRV	Non Return Valve
OBE	Operation Beyond Earthquake
OD	Outer Dia
ODC	Over Dimensional Consignment
OMTI	Fire-resistant Oil
P & ID	Process and Instrument diagrams.
PSAR	Preliminary safety analysis reports
PPE	Personnel Protective Equipment
PQR	Procedure Qualification Record
P&M	Plant and machinery
QA	Quality Assurance
QAP	Quality Assurance Plan
RA bill	Running Account bill
RT	Radiographic Testing
RTD	Resistance Temperature Detector
SCC	Special Conditions of Contract
SCPP	Secondary Cycle Piping
SMAW	Shielded Metal Arc Welding
SS	Stainless Steel
SSE	Safe shutdown earthquake
STG	Shaft Turning Gear

## TECHNICAL CONDITIONS OF CONTRACT

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STD	Standard Transfer Document
SWS	Sea Water Systems
TCG	Turbine Control Gear
TDFP	Turbine Drive for Feed Pump
TG	Turbine Generator
Ti	Titanium
TSI	Turbovisory Instruments
TSS	TG & Secondary Cycle and Sea water systems
UDP	Unit Demineralisation Plant
UT	Ultrasonic Testing
VBT	Vaccum Box Testing
VTF	Valve Testing Facility
WCMS	Work Contracts Management System
WD	Working Document
WIR	Weld Inspection Report
WPS	Welding Procedure Specifications

# TECHNICAL CONDITIONS OF CONTRACT

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## Annexure - II

### List of associated KKS codes:

KKS Code	System Designation
GHA	Servo motor cooling water system
GMA	Oil containing water sewerage system
JEA50	SG level monitoring and pipeline steam humidity
LA.	Feed water systems
LAA	Feed water collecting and de-aeration system
LAB	Main feed water piping system
LAC	Feed water pump system
LAD	HP regeneration system
LAH	Auxiliary feed water piping system
LAJ	Auxiliary feed water pump system
LAV	EDFP lube oil system
LB.	Steam piping system
LBA	Main steam piping system
LBA90	Temporary system of pre-starting steam line blow-off
LBB	System of superheat steam piping in LP cylinder (including steam re-heater)
LBF10	BRU-SN system
LBF50-60	BRU-D system
LBG	Auxiliary steam piping system
LBG10-70	Auxiliary steam line system
LBG90	HPH preheating system
LBJ	Steam moisture separation system in LP cylinder
LBK	BRU-A system
LBQ	HP steam extraction piping system
LBR	TDFP steam supply system
LBS	LP steam extraction piping system
LBW	Turbine sealing steam system
LBW10-20,	Turbine sealing steam system (including valve stems)

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LBW30-50	TDFP sealing steam system (including valve stems)
LC.	Condensate systems
LCA	Main condensate piping system
LCA70	System of main condensate supply to the deaerator and of auxiliary pipelines
LCA90	System for pre-starting flushing of the condensate and feeding line
LCB	Main condensate pump system
LCC	LP heaters system
LCE	Condensate injection to BRU-K system
LCG	TDFP turbine condensate pump system
LCH	HP heater condensate system
LCJ	LP heater condensate system
LCM	Turbine hall drains system
LCM10-70	Turbine hall drains system (condensate collecting and return)
LCM80-90	Turbine hall drains system (condensate collecting and return for active water treatment)
LCN	HP steam piping drains system
LCO	Non Condensate gases removal from CEP1st, CEP2nd and LCT Pumps HX Casing
LCP	Turbine hall demineralized water system
LCR	TDFP turbine condensate system
LCS	Re-heater heating steam condensate system
LCT	MS/SR moisture separator condensate system
LCW	Sealing and cooling steam drains system
LCX	Feeding pipeline of NRV with servomotor
LD.	Condensate polishing systems (UDP)
LDB	Autonomous dematerializing plant system
LDF	Turbine condensate deironing and polishing demineralization system (UDP)
LDN	Component cooling water chemistry control system
LDP	Spent resins from UDP regeneration and flushing system
LDR	UDP washing and regeneration water system
LF.	Common installations for steam, water, gas cycles
LFN	Secondary working fluid correction treatment system

# TECHNICAL CONDITIONS OF CONTRACT

LST	Balancing piping of moisture separator re-heater for separate
MA.	Steam turbine plant
MAA	HP cylinder system
MAC	LP cylinder system
MAG	Turbine condensers system
MAJ	Air removal system
MAK	Jacking oil system
MAL	Turbine drain system
MAM	Seal leak-off steam system
MAN	BRU-K system
MAQ	Main turbine oil vapour removal system
MAV	Main Turbine Generator lube oil system
MAX	Main Turbine governing oil system
MKG	Generator hydrogen cooling system
MKW	Seal oil system
MVA10-40	Turbine hall loads lubricant supply system
MVA50	Emergency lubricant discharge system
MVA60-70	Mineral oil supply system
MVM	Turbine hall loads lubricants leak collecting system
MXN	BRU-K governing oil system
O-System	Exhaust system
PG.	Closed cooling water system for conventional area
PGB	Closed cooling water system for conventional area
PGB00-70	Closed cooling water system for normal operation loads
PGB80-90	Closed cooling water system for oil coolers
QJ.	Central gas supply, also inert gas
QJB50	Nitrogen supply and distribution in turbine hall
QJC	Hydrogen supply
QJC10	System for supplying hydrogen and distribution it in the turbine hall
QU.	Secondary automated chemical monitoring system
QUA	Automated chemical monitoring system for feedwater systems
QUB	Automated chemical monitoring system for steam systems
QUC	Automated chemical monitoring system for condensate systems
QUD	Sampling system for the auxiliary steam generation

# TECHNICAL CONDITIONS OF CONTRACT

QUG	Automated chemical monitoring system for unit demineralizing plant systems
QUH	Sampling system for secondary cycle and condensate polishing plant
SC.	Stationary process air systems
SCB10	Compressed air supply and distribution systems in turbine hall (for generator gas station)
XA.	TDFP Turbine
XAC	Turbine drive for feed pumps
XAG	Condensing system for TDFP turbine
XAQ	TDFP oil vapour removal system
LVA/XAV	TDFP lube oil system
PA.	Main cooling water system
PAA	Mechanical cleaning system
PAB	Main cooling water piping system
PAB90	Auxiliary piping of valves for "inlet - outlet" of air from turbine condenser
PAC	Main cooling water pump
PAS	Turbine and lifting pumps ejectors
PAY	System for measuring pressure differential at water and level lattices and screens in the facilities for cooling water intake and supply
PAX	Pressure air supply to pressure differential gauge and water level gauge
PC.	Cooling water system of non-essential loads
PCB	Cooling water piping system of non-essential loads
PCC	Cooling system of cooling water pump of non-essential loads
PCB51,52	Cooling water system of NPP diesel power plant
PE.	Cooling water system of essential loads
PEA	System of mechanical cleaning
PEB	Cooling water piping system of essential loads
PEC	Cooling system of cooling water pump of essential loads
PEX	System of air supply to the instruments measuring the pressure differential and water levels in PEA system

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PEY	System of air supply to the instruments measuring the pressure differential and water levels in PEC system
PU.	System of common plants
PUA	System for pumping out of pump house flow circuit of main cooling water and cooling water of non-essential loads
PUD	System for pumping out of pump house flow circuit of cooling water of essential loads
PUE	System for drain water pumping out from pump houses of essential loads
PUK	System for washout of PAA system revolving screens
PUJ	System for washout of trashrack tray of median purification of PAA main system
PUP	System for washout of trash rack tray of median purification and PEA system revolving screens
PUQ	Tunnel discharge water drain system
PUV	Oil supply system of pump houses
PUN	Sea water supply system to Chlorination plant
PUL	Fish diversion ejector power supply system
PUS	Cooling system of fish pump
PUM	Airlift power supply system
PUT	Fish protection facility service rooms drainage
PUX	System of air supply to the instruments measuring the pressure differential and water levels in intake structure.
GML	Drainage water pumping out from main pumping house
SCD	Compressed air system
UMA	Turbine Building
UMV	T & G Oil Building
UMW	TB emergency oil discharge tank
1UGZ	Process tunnel to tanks 1UGB, 2UGB, UGC
2UGZ	Process channel to tank 1UGS
UQA	Main pump house

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UQC	Essential load pump house
UQD	Pressure pipelines of main cooling water structure
UQE	Discharge pipelines of main cooling water structure
UQG	Inlet portal of discharge pipeline
UQN	Discharge channel
UQR	Chiller building
UQU	Discharge Pipeline
UQW	Outlet portal of discharge pipeline
UQX	Siphon wells
UQZ	Essential loads pipeline tunnels
UPC	Intake structure
UPK	Chlorination plant
UPU	Fore bay
UPX	Fish protection facility
UGW	Controlled access area waste water treatment plant
UJA/UKA	Reactor building
1-4UKD	Emergency power supply and control building
05UKD	Common station diesel generator building

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## ANNEXURE-III

### BUILDING DESCRIPTION

#### 1. UMA-Turbine building:

Turbine building (UMA) is a reinforced concrete structure of approximate size 94.4 m by 57 m in plan and is approximately 46 m high. The building has two levels of basement at elevation – 7.2 m and -4.200 m levels and above ground at elevations 0.000, +6.0 m, +7.8m, +10 m (structural floor), +16.0 m, +20.0 m and +28.7 m.

Details of some of the major equipment located at various floors of UMA are as given below;

Floor	Equipment
-7.2 m	Condenser, CEP-1, CEP-2, LCM Tank etc
-4.2 m	Debris filters, Ball Cleaning Filters for TDFP's etc
0.0 m	MSR's, HP & LP Heaters, TDFP Condensers etc
+6 m	EDFP's, TDFP's, AFWP etc
+7.8 m	Condenser Ejectors, Gland Steam Condenser etc
+10.0 m (Platform)	MKG system Evaporator, Refrigeration unit, PGB tank compensator etc
+16.0 m	HP and LP turbines, UDP system, Generator etc
+20.0 m (Platform)	Steam Dump Valves from Ring Header etc
+28.7 m	De-Aerator column and storage tank etc

The details of elevations and equipment locations provided are just for reference. Actual elevations and equipments per floor shall be as per the original drawings issued for KK 3&4.

#### 2. UMG-T&G oil building:

Turbine and Generator Oil building (UMV) is a reinforced concrete structure of approximate size 14 m by 12 m in plan and is approximately 45 m high. As the name implies, the building houses the various oil systems of Turbine and Generator namely MAV, MAK, MKW etc. The building has two levels of basement at elevation – 7.2 m and -3.6 m levels and above ground at elevations 0.0 m, +3.9 m, + 8.1 m, + 12.3 m, +16.8 m and + 22.1 m

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Details of some of the major equipment located at various floors of UMV

Floor	Equipment
-7.2 m	PGB system Pipelines,
-3.6 m	Submergible pump
0.0 m	BRU-K oil tank, Oil governing system pump, MKW pumps and filters, MVA system for oil filling to tanks etc
+3.9 m	MKW oil tank, Oil coolers etc
+8.1m	Oil Coolers and storage tank of Lube oil System etc
+12.3 m	Exhaust fans for vapor evacuation etc
+16.8 m	MKW filters etc
+22.1 m	MKW Damper tanks (on Platform at +24.5 m)

The details of elevations and equipment locations provided are just for reference. Actual elevations and equipments per floor shall be as per the original drawings issued for KK 3&4.

### **3. UMW-Turbine building emergency oil discharge structure :**

The Emergency Oil discharge tank (UMW) is a rectangular underground concrete structure with metal casing. The tank is located at the basement location of -5.000 m outside to the south of UMA building. The dimensions of the tank are 8.8 m x

4.8 m x 4.55 m. The main purpose of the structure is to facilitate for the storage or discharge of oil under emergency conditions from UMV building. The tank is provided with hatches and breather for the discharge of oil vapours to atmosphere. The details of elevations and equipment locations provided are just for reference. Actual elevations and equipments per floor shall be as per the original drawings issued for KK 3&4.

### **4. 2UGZ- Process tunnel:**

The process tunnel (2 UGZ) connecting Turbine building (UMA) south side and UGS structure for LDR tank. The tunnel is of size 780mm width x 1450 mm height and is provided for accommodating LDR pipelines. The top of the tunnel is covered with concrete slabs with water proofing.

### **5. 1UGZ- Process tunnel:**

## **TECHNICAL CONDITIONS OF CONTRACT (TCC)**

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The process tunnel (1 UGZ) connecting Turbine building (UMA) west side, UGB & UGC structure for LCP & LCM tank respectively. The tunnel is of size 4200 mm width x 3500 mm height and is provided for accommodating LCP & LCM pipelines.

### **6. 2USF –Nitrogen receivers structure:**

The nitrogen receivers structure is a concrete foundation structure of size 7000 mm x 3200 mm on the south side of turbine building for installation of 2 nos of nitrogen receiver tanks (QJB).

### **7. UQA -Main pump house:**

Main pump house UQA is provided within the nuclear island in the zone of common access on the coast of the Gulf of Mannar. The pump house will be connected with the intake structure UPC through the inlet pipeline, UPN, and forebay UPU. It consists of a substructure and superstructure. The substructure is dimensioned in plan 91.50 m x 47.80 m and superstructure 91.50 m x 16.00 m, height of the superstructure being 16.00 m. Contraction joints will divide the main pump house UQA into four sections. The first section of 33.00 m x 25.40 m size in plan will be intended for pump units PCC and heat exchangers. The second and third sections of 23.00 m x 47.80 m size in plan each, will be intended for installation of six pump units PAC, while the fourth section of 12.50 m x 25.40 m size in plan will serve as a service bay.

The main pump house technologically is connected with the turbine building, UMA, by six underground reinforced concrete pipelines of the system PA. It consists of intake part with equipment and a set of mechanical cleaning devices PAA installed therein and rooms for pump units and other equipment. The intake part is 42.00 m wide and 26.90 m long along the flow. The intake part is divided by piers into six water cleaning lines. Each line, 5.00 m wide, will be provided with secondary screens and fine-mesh rotary screens as well as with slots for installation of bulkheads.

The bottom of the intake part is at EL. -11.000 m, the top of it - at EL. +7.550 m where stationary screen raking mechanisms and fine-mesh rotary screen drive will be installed. All water cleaning lines adjoin a cross-wise inlet channel from which all pump units of systems PA and PC will get suction.

The substructure for pump units and other equipment is a reinforced concrete underground building, 20.90 m x 91.50 m size in plan consists of four main floors. The floors will be located at EL. - 7.350 m, - 3.300 m, +2.850 m and +7.650 m.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

The main pump axis will be at EL. - 6.300 m. Pump unit motors for PAC and PCC pumps, will be located at EL. +7.650 m. The axis of pump units PCC of the cooling water system of non-essential loads PC will be at EL. - 3.500 m. At the entry of the pump suction pipe bulkheads will be installed to provide dismantling the pumps after dewatering the suction chamber.

The main pump house accommodates six pump units of main cooling water system (PAC), three pump units PCC together with heat exchangers of cooling water system for non-essential loads PC, and common devices for cooling water systems PU.

Total eight pump units of the secondary and fine-mesh rotary screens of the screen cleaning system will be located at EL. +2.850 m. Water will be taken from the cross-wise inlet channel at EL. minus 4.000 m through a separate water conduit 2.50 m x 2.00 m. Two pumps for dewatering the wet gallery will also be installed at EL. +2.850 m.

### **8. UQC -Essential load pump house:**

The cooling water system of essential loads PE consists of four independent physically separated channels. Two pump houses will serve one unit, so that one pump house is designed to be a common element for two channels of PE system. Each pump house of essential loads UQC will consist of superstructure and substructure. The substructure will be 19.20 m x 32.40 m in plan, the superstructure 19.20 m x 16.00 m.

The maximum depth of setting the substructure with respect to the ground levelling EL. +7.550 m will be 16.65 m. The height of the superstructure will be 11.45 m.

The pump house of essential loads technologically will be connected to the reactor building UJA and emergency power supply and control building UKD through the tunnels intended for the pipelines of essential loads UQZ.

The pump house of essential loads 1UQC will be of two sections: an intake portion 33.00 m x 22.40 m in size and the rooms for installing pump units 19.20 m x 32.40 m in size.

Pump house 2UQC: Intake portion is 12.50x22.40 m in size, and a room for pump units, 19.20 m x 32.40 m in size. The intake portion of each pump house has one water cleaning line, 3.00 m wide, connected with cross-wise inlet channel of the same unit.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Secondary screens and rotary fine-mesh screen as well as the slots for bulkheads installation are located within the area of water cleaning line. The intake portion bottom is at EL. - 7.000 m, top at EL. +7.550 m whereat fixed raking mechanisms of screens and rotary fine mesh screens drive are installed.

The other unit (pump units room) houses the forebay connecting with cross-wise inlet channel of PE system and cross-wise channel of PA system, 2.50 m x 2.00 m in size which may be considered as the second line of water supply line for each pump house of essential loads, UQC.

One water cleaning line in the intake portion and the cross-wise inlet channel are designed to pass jointly a discharge of 8380 m<sup>3</sup>/hour required for two channels of PE system

The pump units and other equipment will be housed in an underground reinforced concrete building of four main floors located at ELs. -4.200 m; +1.800 m and +7.650 m. A stairway located between the two independent channels will interconnect the floors. Entrance to each room on the staircase side will be provided only through a watertight door.

Cooling water system of essential loads PE with two pump units PEC and common devices for cooling water systems PU are located in UQC building.

The pumps provided for washing the secondary and fine-mesh rotary screens will be located at EL. +7.650 m. Water will be taken from forebay connected with the crosswise inlet channel at EL. - 6.400 m through a special chamber, 2.50 m x 2.00 m, where a slot for the bulkhead is provided. The suction chamber of these pumps is located from EL. minus 4.200 m to +1.000 m.

### **9. UPC -Intake structure:**

The intake structure is located in the Gulf of Mannar within the water area enclosed by breakwater dyke 0 UZQ and distant from the shore-line to 329.70 m South. The intake structure UPC is integrated with the initial section of the fish- protection facilities UPX equipped with airlift. Flow velocity at the entry to the intake structure UPC equals 0.69 m/s.

### **10. UPX- Fish protection facility:**

The fish protection facility UPX is located right behind the intake structure UPC within the breakwater dyke 0 UZQ upstream of the sea water inlet pipe UPN. It is intended to prevent both fish and zooplankton from entering the intake structure and is suitable for continuous operation. Each FCVS (fish protection concentrator with vertical separator) section is designed as an open reinforced concrete flume with contracting vertical walls in plan.

## **TECHNICAL CONDITIONS OF CONTRACT (TCC)**

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The FCVS sections are divided by vertical walls. The thickness of the side walls is 2.00 m at the top, that of intermediate walls is 1.50 m and of the flumes- concentrators 1.00 m. Between the walls of the fish-diversion facility flumes above the entry to the pipeline UPN two two-storey pump control buildings will be provided. The ground floor at el. minus 4.400 m will house the pumps for ejecting the flow in the fish-diversion facility (one in each room). To supply water to the pumps intake openings outgoing to the pipeline UPN will be provided in the lower flooring of the ground floor. The first floor at EL.+1.000 m will accommodate pump motors, pump control system as well as compressors for the airlift (one in each room) creating an air-bubble curtain at the entry to the FCVS. The pumps are interconnected by a pipeline equipped with a branch pipe with an ejector nozzle in each flume. The compressors are also interconnected by headers – air ducts with horizontal perforated pipes placed in front of inlet sills of each FCVS section.

### **11. UQX- Siphon wells:**

The siphon wells are incorporated in the structure of the cooling water supply system UQ and will serve as conjugation structures between the pressure pipes of PA, PC and PE cooling water systems and discharge channels UQN. Four siphon wells - 1UQX, 2UQX, 3UQX and 4UQX located at the construction facilities site in the free access zone will serve each NPP unit. Each siphon well includes a cooling water receiving chamber and a weir.

The receiving chamber of siphon well 1UQX of the main cooling water system PA will have six sections, each of which connected through a transition section to one of main condenser cooling water discharge pipelines PAB, 2200 mm diameter. At the entry the chamber will have a weir with the crest at EL. +4.600 m providing the required vacuum in the turbine condensers.

Since the maximum design downstream level is 5.10 m higher than the crest elevation, the weir is provided with slot structures for bulkhead gates. A steel scaffolding with electric movable hoist and walkways on both sides of the weir will be erected on the piers for handling the gates. To store two bulkhead gates a gate storage room will adjoin the siphon well.

The receiving chamber of siphon well 2UQX of the cooling water system PA will have one section to which cooling water will be supplied through pipeline PAB89, 1200 mm in diameter. At the exit the receiving chamber will have a weir with the crest at EL. +5.5m. The siphon wells 2UQX and 3UQX are located on both sides of the discharge channel 1UQN. From siphon wells 4UQX water is discharged to the Gulf of Mannar through discharge channels 2UQN.

### **12. UPU- Fore bay:**

The fore bay UPU is a common structure for the PA, PC and PE systems. It is 43.40 m long is located between the sea water inlet pipeline UPN and main pump house UQA whose open section, 35.90 m long is widened from 13.30 to 56.00 m.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### **13. UPN- Inlet pipeline:**

The inlet pipeline UPN is located between fish-protection facilities UPX and fore bay UPU.

### **14. UQZ- Essential load pipeline tunnels:**

Essential loads pipelines tunnels UQZ are meant for ensuring protection of pipelines system PEB against external impacts (fill soil, ground waters, transport and extreme loads on the NPP territory), as well as for access to pipelines during operation and repairs.

Tunnels will be located in the common-access area and in the controlled-access area of the NPP nuclear island. They will run from the essential loads pump houses 1UQC & 2UQC to the reactor building UJA and emergency power supply and control buildings 1-4UKD. Tunnels will be laid underground 12.00 m deep near building 1UQC & 2UQC and 4.00 m deep near buildings 1-4UKD. Pressure and discharge pipelines PEB10 and PEB20 will be laid in tunnels 1UQZ bending around the reactor building from the west. Pressure and discharge pipelines PEB30 and PEB40 will be laid in tunnels 2UQZ located in the east side of the reactor building. All tunnels are through.

### **15.0 UGW- Sewage water biological cleaning station of the controlled access area**

Sewage water biological cleaning station of the controlled access area 0 UGW includes the structures of Pump house with receiving tank (01UGW), Auxiliary- production building (02 UGW), Sand-trap (03UGW), Receiving tank (04UGW), Bio-filter (GQD06BB001, GQD06BB002), Stabilizer (05UGW001, 05UGW002), Sediment tank (06UGW001-06UGW004), Cleaned wastes container (07UGW), Contact tank (08UGW001, 08UGW002), Sand bed (09UGW), Sludge beds (01UGT), Gas release tube (11 UGW) and Pump house of the cleaned wastewater (03UGT).

Biological cleaning station (0UGW) is designed for complete wastewater biological cleaning at bio-filters with plastic packing (GQD06BB001, GOD06BB002), self- oxidation of excessive bio-film in stabilizers (05 UGW001, 05 UGW002), water disinfection by electrolytic sodium hypochlorite, dewatering of excessive bio-film at the sludge beds (01UGT) and dewatered sediment disinfection by composting.

The main process equipment of biological cleaning station (0UGW) is as follows: bio-filters (GQD06BB001, GOD06BB002), pumps (GQD05AP001, GQD05AP002, GQD08AP001, GQD08AP002, GQD15AP001, GQD15AP002, GQD16AP001, GQD16AP002) to be mounted in the auxiliary-production building (02 UGW), which also contains laboratory switchboard room, personal service rooms and air- ventilation chamber.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## ANNEXURE-IV

### SYSTEM DESCRIPTION

#### SEA WATER SYSTEM SYSTEMS:

1. MAIN SEA WATER COOLING SYSTEM (PAB)
2. SEA WATER COOLING SYSTEM FOR ESSENTIAL LOADS (PEB)
3. SEA WATER COOLING SYSTEM FOR NON-ESSENTIAL LOADS (PCB)
4. SYSTEMS OF MECHANICAL CLEANING DEVICES (PAA & PEA)
5. CLOSED COOLING WATER SYSTEM FOR CONVENTIONAL AREA (PGB)
6. SYSTEMS OF DEWATERING (PUA, PUB, PUD, PUE, PUQ & GML)
7. SCREEN AND FLUME WASH OUT SYSTEMS (PUK, PUJ & PUP)
8. COMMON PLANT SYSTEMS (PUV, PUN & SCD)
9. FISH PROTECTION AND DIVERSION SYSTEM (PUL, PUM, PUS, PUX & PUT)
10. INSTRUMENTATION SYSTEM AT THE PUMP HOUSES (PAX, PAY, PEX & PEY)
11. CONTROLLED ACCESS AREA WASTE WATER TREATMENT SYSTEMS (UGW)

#### 1. Main sea water cooling system (PAB):

The main cooling water system is once through system seawater supply system intended for the heat removal from steam in turbine condensers and feed water pump condensers. Cooling sea water will be supplied from the intake through water conveyance system to the common fore-bay. From the fore-bay (UPU) water flows to the common cross-wise inlet channel through secondary and fine mesh rotary screens. From the cross-wise inlet channel, through six condenser cooling water pumps, seawater is supplied to the condensers of the turbine compartment through sea water piping and flows back to sea through siphon wells (UQX), discharge pipe UQU and outlet portal UQW.

Each of 6 pumps supplies 1/6 part of the required discharge via a separate pipeline, 2200 mm in dia. to half-one out of three twin condensers. The water heated in the condensers shall be returned to the Gulf of Mannar via 6 independent discharge pipes, 2200 mm in dia. and siphon wells separate for each pipe.

Apart from cooling water supply of the turbine condensers the main cooling water system supplies water to feed pumps condensers and to those of the ejectors.

#### 2. Sea water cooling system for essential loads (PEB):

This system is intended to remove heat from the intermediate circuits of heat exchangers in the reactor building UJA and intermediate circuit of the diesel- generator building and safety-related system 1-4UKD. The system for each unit consists of 4 nos. of individual channels of cooling water.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### **3. Sea water cooling system for non-essential loads (PCB):**

This system is intended for heat removal from the intermediate circuit of turbine building normal operation heat exchangers, the intermediate circuit of heat exchangers of oil-filled equipment of the turbine, the intermediate circuit of chillers, the compressors cooling system of compressor building, the cooling system of common-station diesel generators and as service water supply to ejector system in turbine building.

### **4. System of mechanical cleaning devices (PAA & PEA):**

The system of mechanical cleaning devices PAA is intended for cleaning the main condenser sea water cooling system (PAB) and sea water cooling system for non-essential loads (PCB). The system of mechanical cleaning devices PEA is intended for cleaning the sea water cooling system for essential loads (PEB). Both PAA & PEA clean the sea water from floating debris and biomass with a size more than 4 mm entering into the above systems. It consists of the three sequential stages of water cleaning i.e. coarse screens, secondary screens & rotary fine mesh screens. Provision is made in the system for the isolation of various chambers by suitable gates at various locations in order to carry out inspection & cleaning etc.

### **5. Closed cooling water system for conventional area (PGB):**

These Intermediate circuit closed cooling water systems for conventional area (PGB01, PGB10, PGB80 & PGB84) are to provide cooling water for the equipment located in the UMA turbine building, UKC building, the special laundry UKW, UKS building for reprocessing and interim storage of solid radioactive waste and for cooling oil system of turbine building compartment. Heat exchangers (intermediate circuit to sea water), pumps are located in UQA building. Process heat exchangers (intermediate circuit to process system) are located in various other buildings.

### **6. Systems of dewatering (PUA, PUD, PUE, PUQ & GML):**

The stationary pumping out system PUA is intended for dewatering the water path of the pumps of the main cooling water system PAC and the pumps of the non-essential loads cooling water PCC including the pressure pipelines PAB and PCB. The PUA system is common for PAC and PCC systems.

For discharge portions of pipelines PAB, PCB, PEB and siphon wells portable submersible pumps will be used which can be placed at the bottom of the foundation slabs of the structure to be dewatered.

## **TECHNICAL CONDITIONS OF CONTRACT (TCC)**

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For dewatering the sea water path of the pump units of the essential loads cooling water system PEC and pressure portions of the pipelines PEB a stationary pumping out system PUD is provided

PUE system is intended to remove drainage water from the pump houses of essential loads 1UQC and 2UQC. The drainage water pumping out system is designed separate for each house where essential loads pump units will be installed. GML and PUQ system are meant for collecting and pumping out drains from main pump house and tunnels.

### **7. Screen and flume Wash out System (PUK, PUJ and PUP):**

The system is designed for washing off the debris sticking to the underwater part of the rotary mesh screens. The PUK system includes two groups of pump units for washing. Each group consists of two pumps, one of which is service and the other is standby & also includes supply pressure pipelines & valves for pipes.

The system PUJ is designed for washing out trash in the flume. The trash removed by a stationary raking machine from secondary screens will be put in common flume where from it will be washed with water of PUJ system and collected in trash bin for disposal.

The system PUP is designed for removal (washing) of the debris retained by the secondary screens and rotary meshes of the mechanical cleaning system of cooling water for essential loads (systems PEA).

### **8. Common plant systems (PUV, PUN & SCD):**

PUV system is for Oil supply to pump houses, PUN system is Sea water supply system to Chlorination plant and SCD is compressed air system.

### **9. Fish protection system (PUL, PUM, PUS, PUX & PUT):**

Fish-protection system comprised of fish diversion ejector water system (PUL), airlift supply system (PUM) with auxiliary system such as pump motor winding, bearing oil cooling system (PUS) and drainage system is provided to divert fishes from entry to the cooling water system. PUM compressors are provided to supply compressed to air lift system for fish protection. The airlift system is located in the downstream breakwater dyke of water intake area consisting of three sections - two services, one standby - with straight-flow open fish-diversion facility operated by a hydraulic ejector.

### **10. Instrumentation system at the pump houses (PAX, PAY, PEX and PEY):**

These instrumentation systems are for measurement of pressure differential on screens and meshes and water levels in cooling sea water supply at the pump houses UQA, 1UQC and 2UQC. The systems serve to make measurements and follow up the pressure

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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differential at the screens and meshes of the cooling sea water mechanical cleaning devices and water levels in all the cooling water supply structures to the pump units of PAC, PCC and PEC.

### **11. Controlled access area waste water treatment plant (UGW):**

This system is a waste water treatment plant provided for treatment of sewage water collected from various buildings of controlled access area and transported through outdoor pipe line network of sewage water (GQD) to the plant. The equipment and pipe lines of the system shall be issued as free issue material to the contractor for erection.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## ANNEXURE-V

### Pipe sizes of Free issue materials

Sl.no.	Size of pipe in OD (mm)	Size of pipe in Inch for inch-dia and inch-m calculation
1	10	0.5
2	12	0.5
3	14	0.5
4	16	0.5
5	18	0.5
6	20	0.75
7	25	0.75
8	28	0.75
9	30	1
10	32	1
11	34	1
12	38	1.25
13	40	1.25
14	45	1.5
15	55	2
16	56	2
17	57	2
18	76	2.5
19	89	3
20	108	4
21	133	5
22	159	6
23	219	8
24	220	8
25	273	10
26	325	12
27	377	14
28	426	16
29	465	18
30	530	20
31	630	24
32	720	28
33	820	32
34	920	36
35	1020	40
36	1140	44
37	1220	48
38	1420	56
39	1848	72
40	2060	80
41	2220	88
42	2420	96



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

NUCLEAR POWER CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

गुणवत्ता आश्वासन निदेशालय

Directorate of Quality Assurance

नाभिकीय ऊर्जा भवन, अणुशक्तिनगर, मुंबई-400 094

Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

Corporate Identification No. U40104MH1987GOI149458



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सं.No. एनपीसीआईएलNPCIL/02500/क्यूएडी QAD/एमएम/2019/1161

दिनांक Date: December 17, 2019

विषय : वेल्डिंग कंज्यूमेबल्स के अनुमोदित ब्रांड की सूची

**Sub:** List of approved brands of welding consumables

17/12/2019 की स्थिति में एनपीसीआईएल कार्यों के उपयोग हेतु वेल्डिंग कंज्यूमेबल्स के अनुमोदित ब्रांडों की सूची इसके साथ संलग्न है:

The lists of approved brands of welding consumables for use on NPCIL jobs as on 17/12/2019 are enclosed herewith.

- 1) अनुमोदित कार्बन स्टील एवं निम्न एलॉय स्टील वेल्डिंग इलेक्ट्रोड्स की सूची (2 शीट)  
List of Approved Carbon Steel & Low Alloy Steel Welding Electrodes (2 Sheets).
- 2) अनुमोदित स्टेनलेस स्टील एवं अन्य निकिल एलॉय इलेक्ट्रोड्स की सूची (2 शीट)  
List of Approved Stainless Steel & other Ni Alloy Electrodes (2 Sheets).
- 3) वायर के अनुमोदित ब्रांड एवं वायर फ्लक्स संयोजन की सूची (1 शीट)  
List of Approved Brands of Wire and Wire Flux Combination (1 Sheet).

वेल्डिंग कंज्यूमेबल्स (क्यूएडी/प्रापण/वेल्डिंग कंज्यूमेबल्स/002 संशो.: 2) के अनुमोदन के लिए प्रक्रिया में एवं एसएमई खंड II भाग C के अद्यतन संस्करण में निर्धारित आवश्यकताओं के अनुसार अनुमोदन प्रदान किया जाता है। तथापि, विशेष मामलों में जहाँ कहीं भी बैच क्वालिफिकेशन अपेक्षित होगा, अलग से निष्पादित किया जाएगा।

The approvals are granted in conformance to the requirements stipulated in Procedure for approval of Welding Consumables (QAD/Proc/Welding Consumables/002 Rev:2) and latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

*राजेश कुमार गुप्ता*

(आर.के. गुप्ता R.K. Gupta)

अधिशायी निदेशक (गु.आ.) Executive Director (QA)



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.



## 1) LIST OF APPROVED CARBON STEEL & LOW ALLOY STEEL WELDING ELECTRODES

(2 pages)

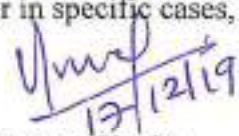
As on 17-12-2019

Sr. No.	Manufacturers	Brand name	AWS No.	Valid up to
1.	ADOR WELDING LTD., SILVASSA	SUPABASE X PLUS	E7018	FEB2024
2.	ADOR WELDING LTD., SILVASSA	MOLYTEN	E7018-A1	APR2020
3.	ADOR WELDING LTD., SILVASSA	CHROMOTEN	E8018 B2	APR2020
4.	ADOR WELDING LTD., SILVASSA	CHROMOTEN-C	E9018 B3	APR2020
5.	ADOR WELDING LTD., SILVASSA	TENALLOY Z PLUS	E7018-1	JUN2022
6.	D&H INDIA LTD., INDORE	SUPER -CR-1	E8018 B2	DEC2020
7.	D&H INDIA LTD., INDORE	SUPER -CR-2	E9018 B3	DEC2020
8.	D&H INDIA LTD., INDORE	SUPER -LH (SPL)	E7018-1 (DCEP Only)	FEB2021
9.	D&H INDIA LTD., INDORE	STANDARD	E6013	FEB2021
10.	D&H INDIA LTD., INDORE	SUPER LH	E7018 (DCEP Only)	FEB2021
11.	D&H SECHERON, INDORE	MEDIO	E6013	JUN2020
12.	D&H SECHERON, INDORE	EXOBEL	E6013	JUN2020
13.	D&H SECHERON, INDORE	SUPER THERME	E7018	JUN2020
14.	D&H SECHERON, INDORE	MOLYTHERME	E7018-A1	JUN2022
15.	D&H SECHERON, INDORE	SUPER THERME(SPL)	E7018-1	NOV2023
16.	HONAVAR ELECTRODES, THANE	REGULAR S	E6013	JAN2020
17.	HONAVAR ELECTRODES, THANE	ULTIMATE - 18	E7018	JAN2020
18.	HONAVAR ELECTRODES, THANE	ULTIMATE - 18 SPL	E7018-1	JAN2020
19.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -13R	E6013	SEP2020
20.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -18	E7018	SEP2020
21.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -18 PLUS	E7018-1	SEP2020
22.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -1 CR	E8018-B2	JUN2024
23.	MAILAM INDIA LTD., PUDUCHERRY	MAILARC -2 CR	E9018-B3	JUN2024
24.	RAJ KESARI ELECTRODES, UDAIPUR	SUPERLET 18	E7018	AUG2022
25.	RAJ KESARI ELECTRODES, UDAIPUR	SUPERLET 18 (SPL.)	E7018-1	AUG2022
26.	RAJ KESARI ELECTRODES, UDAIPUR	RAJCORD 13S	E6013	AUG2022
27.	RAJRATNA ELECTRODES, AHMEDABAD	RATNA 7018 SPL.	E7018-1	MAR2020
28.	RAJRATNA ELECTRODES, AHMEDABAD	RATNA 7018	E7018	NOV2023
29.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM SPL.	E7018-1	SEP2021
30.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL CHROM 1	E8018-B2	FEB2023
31.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL CHROM 2	E9018-B3	FEB2023
32.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM MOLY	E7018-A1	MAR2023
33.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL THERM	E7018	DEC2023
34.	ROYAL ARC ELECTRODES LTD, VASAI	ROYAL S	E6013	DEC2023
35.	SUPERON SCHWEISSTECHNIK INDIA LTD. DELHI	GARANT MO	E7018-A1	SEP2020
36.	SUPERON SCHWEISSTECHNIK INDIA LTD., DELHI	SUPER CROMO 1B	E8018-B2	DEC2020

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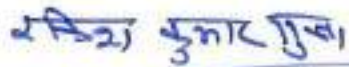
Sr. No.	Manufacturers	Brand name	AWS No.	Valid up to
37.	SUPERON SCHWEISSTECHNIK INDIA LTD., DELHI	SUPER CROMO 2B	E9018-B3	DEC2020
38.	VIJAY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 6013 X	E6013	SEP2020
39.	VIJAY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 7018	E7018	SEP2020
40.	VIJAY ELECTRODES & WIRES PVT. LTD., CHENNAI	VJ 7018 - 1	E7018-1	SEP2020
41.	WELD FAST ELECTRODES, NAGPUR	WELDFAST LH 18	E-7018	MAR2020
42.	WELD FAST ELECTRODES, NAGPUR	WELDFAST LH-18-1	E-7018-1	MAR2020
43.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 0500	E7018-A1	FEB2023
44.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 1500	E8018-B2	FEB2023
45.	WELD FAST ELECTRODES, NAGPUR	WELDFAST CROMO 2251	E9018-B3	FEB2023

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

  
(Anoop Singh)  
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1)

Executive Director (QA)

  
17.12.19



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

NUCLEAR POWER CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

गुणवत्ता आश्वासन निदेशालय

Directorate of Quality Assurance

नाभिकीय ऊर्जा भवन, अणुशक्तिनगर, मुंबई-400 094

Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.



## 2) LIST OF APPROVED STAINLESS STEEL & OTHER NI ALLOY ELECTRODES

(2 Pages)

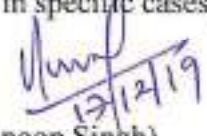
As on 17-12-2019

Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
1.	ADOR WELDING LTD., SILVASSA	BETANOX-DL	E 309L-16	SEP2020
2.	ADOR WELDING LTD., SILVASSA	SUPERINOX-2C	E 316L-16	SEP2020
3.	ADOR WELDING LTD., SILVASSA	SUPERINOX-1C	E 308L-16	SEP2020
4.	D&H INDIA LTD., INDORE	SV-308L	E 308L-15	DEC2022
5.	D&H INDIA LTD., INDORE	SV-309L	E 309L-15	DEC2022
6.	D&H INDIA LTD., INDORE	CROMALLOY-B	E 308L-16	DEC2022
7.	D&H INDIA LTD., INDORE	CROMALLOY 309L	E 309L-16	DEC2020
8.	ADOR FONTECH, BENGALURU	LH 511	E Ni Cu7	OCT2020
9.	ADOR FONTECH, BENGALURU	LH 521	E Ni Cr Fe 3	OCT2020
10.	D&H SECHERON, INDORE	CRONITHERME 25/12	E 309-16	JUN2022
11.	D&H SECHERON, INDORE	RUTOX-D	E 316L-16	JUN2022
12.	D&H SECHERON, INDORE	BATOX-B	E 308L-15	JUN2020
13.	D&H SECHERON, INDORE	RUTOX-B	E 308L-16	JUN2020
14.	D&H SECHERON, INDORE	D&H 309L	E 309L-16	NOV2023
15.	D&H SECHERON, INDORE	D&H 1250	E NiCu-7	JAN2021
16.	D&H SECHERON, INDORE	D&H 1212NS	E NiCr Fe-3	JAN2021
17.	D&H SECHERON, INDORE	RUTOX-A	E 308-16	NOV2023
18.	D&H SECHERON, INDORE	RUTOX-A St	E 347-16	NOV2023
19.	D&H SECHERON, INDORE	RUTOX-Mo	E 316-16	NOV2023
20.	HONAVAR ELECTRODES, THANE	SILVER SHINE 308L-15	E 308L-15	FEB2024
21.	HONAVAR ELECTRODES, THANE	SILVER SHINE 316L	E 316L-16	FEB2024
22.	RAJRATNA ELECTRODES, AHMEDABAD	RATNA 308L	E 308L-16	MAR2020
23.	RAJRATNA ELECTRODES, AHMEDABAD	RATNA 316 L	E 316L-16	MAR2020
24.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-A	E 308-16	JUN2024
25.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-AL	E 308L-16	JUN2024
26.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-AL-15	E 308L-15	JUN2024
27.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12	E 309-16	JUN2024
28.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12-L	E 309L-16	JUN2024
29.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX-25/12-Mo	E 309 Mo-16	JUN2024
30.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX Mo	E 316-16	JUN2024
31.	MAILAM INDIA LTD., PUDUCHERRY	MAILEX MoL	E 316L-16	JUN2024
32.	ROYAL ARC ELECTRODES, VASAI,	ROYAL 1C	E 308L-16	OCT2024
33.	ROYAL ARC ELECTRODES, VASAI,	ROYAL 2C	E 316L-16	OCT2024

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Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
34.	ROYAL ARC ELECTRODES, VASAI,	ROYAL-D2L	E 309L-16	OCT2024
35.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 308L	E 308L-16	JAN2021
36.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 316L	E 316L-16	JAN2021
37.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 309L	E 309L-16	JAN2021
38.	WELD FAST ELECTRODES, NAGPUR	WELDFAST 309MoL	E 309LMo-16	JAN2021

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

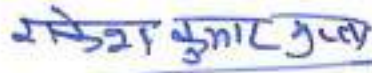
  
(Anoop Singh)  
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1)

  
17/12/19

  
17/12/19

Executive Director (QA)

  
17-12-19



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

NUCLEAR POWER CORPORATION OF INDIA LTD.

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गुणवत्ता आश्वासन निदेशालय

Directorate of Quality Assurance

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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.



## 3) LIST OF APPROVED BRANDS OF WIRE AND WIRE FLUX COMBINATION

(1 Page)

As on 17-12-2019

Sr. No.	MANUFACTURERS	BRAND NAME	AWS No.	VALID UPTO
1.	ADOR FONTECH, BENGALURU	TIG 120	ER 308L	OCT2024
2.	ADOR FONTECH, BENGALURU	TIG 121	ER 316L	OCT2024
3.	ADOR FONTECH, BENGALURU	TIG 123	ER 309L	OCT2024
4.	ADOR FONTECH, BENGALURU	TIG 120S	ER 347	OCT2024
5.	ADOR FONTECH, BENGALURU	TIG 521	ER NiCr3	OCT2024
6.	ADOR WELDING LTD., SILVASSA	TIGFIL 70S-2	ER 70S-2	FEB2022
7.	ADOR WELDING LTD., SILVASSA	TIGINOX-308L	ER 308L	SEP2020
8.	ADOR WELDING LTD., SILVASSA	TIGINOX-309L	ER309L	SEP2020
9.	ADOR WELDING LTD., SILVASSA	AUTOMIG 70-S6	ER 70S-6	DEC2023
10.	ADOR WELDING LTD., SILVASSA	AUTOMELT-B71 AUTOMELT-EH 14 WIRE	F7A2-EH14	FEB2024
11.	D&H INDIA LTD., INDORE	SUPER TIG 308L	ER 308L	DEC2020
12.	D&H INDIA LTD., INDORE	SUPER TIG 309L	ER 309L	DEC2020
13.	D&H SECHERON, INDORE	FILLER WIRE FW 308L	ER 308L	FEB2021
14.	D&H SECHERON, INDORE	FILLER WIRE FW 309L	ER 309L	FEB2021
15.	D&H SECHERON, INDORE	F 70 S2	ER 70S-2	JUN2022
16.	RAJRATNA ELECTRODES, AHMEDABAD	RAAJTIG ER 308L	ER 308L	MAR2020
17.	RAJRATNA ELECTRODES, AHMEDABAD	RAAJTIG ER 316L	ER 316L	MAR2020
18.	VENUS WIRES, KHOPOLI	VENUS 308L	ER 308L	SEP2021
19.	VENUS WIRES, KHOPOLI	VENUS 316L	ER 309L	SEP2021
20.	VENUS WIRES, KHOPOLI	VENUS 309L	ER 316L	SEP2021
21.	VENUS WIRES, KHOPOLI	VENUS 347	ER 347	SEP2021
22.	WELD FAST ELECTRODES, NAGPUR	TIG FAST-3	ER 70S-2	JAN2021
23.	WELD FAST ELECTRODES, NAGPUR	MIG FAST-1	ER 70S-6	JAN2021

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

(Anoop Singh)

ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1)

Executive Director (QA)

रविंद्र कुमार ठाकुर  
17.12.19

कमलेश कुमार ठाकुर  
17/12/19

श्री अ. क. सिंह  
17/12/19



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

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Directorate of Quality Assurance

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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.

Corporate Identification No. U40104MH1987GOI149458



आर.के. गुप्ता R.K. Gupta

अधिशाली निदेशक (गु.आ.) Executive Director (QA)

Phone: 022- 25995030/25558487

Fax.No.: 022-25565354

e-mail: rk\_gupta@npcil.co.in

सं. No. एनपीसीआईएल/NPCIL/02500/क्यूएडीQAD/ईडीED(क्यूएQA)/एमM/2019/1160

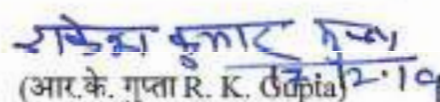
December 17, 2019

**विषय : वेधी पदार्थों के अनुमोदित ब्रांड की सूची।**

**Sub: List of approved brands of penetrant materials**

17-12-2019 की स्थिति में एनपीसीआईएल के उपयोग हेतु वेधी पदार्थों के अनुमोदित ब्रांड की सूची इसके साथ संलग्न है। यह अनुमोदन हमारी प्रक्रिया संख्या QAD/NDT-PROC-PT-05 (तरल वेधी परीक्षण के लिए उपयोग में आने वाले रसायन परिवार के अनुमोदन हेतु प्रक्रिया) के अनुसार आवश्यकताओं के अनुरूप प्रदान किया जाता है।

The list of approved brands of penetrant materials for use on NPCIL jobs as on 17-12-2019 is enclosed herewith. The approvals are granted in conformance to the requirements as per our procedure no. QAD/NDT-PROC-PT-05 (Procedure for approval of Family of Chemicals used for Liquid Penetrant Examination).



(आर.के. गुप्ता R. K. Gupta)

अधिशाली निदेशक (गु.आ.) Executive Director (QA)



# न्यूक्लियर पावर कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उद्यम)

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Nabhikiya Urja Bhavan, Anushaktinagar, Mumbai - 400 094.



## LIST OF APPROVED PENETRANT TESTING MATERIAL

(As on 17-12-2019)

Sr. No.	Manufacturers	Brand name	Description	Valid up to
1.	DYEGLO PVT. LTD, PUNE	RP-81	Red Coloured Solvent Removable Penetrant	DEC2023
2.	DYEGLO PVT. LTD, PUNE	RP-90	Red Coloured Water Washable Penetrant	DEC2023
3.	DYEGLO PVT. LTD, PUNE	CL-01	Solvent Cleaner	DEC2023
4.	DYEGLO PVT. LTD, PUNE	RD-01	Solvent Base Developer suitable for RP-81 & RP-90	DEC2023
5.	DYEGLO PVT. LTD, PUNE	FP-01	Fluorescent Solvent Removable Penetrant	DEC2023
6.	DYEGLO PVT. LTD, PUNE	WD-01	Solvent Base Developer suitable for FP-01.	DEC2023
7.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-911, FC-811 FC-711	Solvent Removable (Visible)	FEB2022
8.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-931, FC-811	Water Washable (Visible)	FEB2022
9.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-941, FC-821	Water washable (Fluorescent)	FEB2022
10.	FERROCHEM NDT SYSTEM PVT. LTD. PUNE	FC-921, FC-821, FC-721	Solvent removable (Fluorescent)	FEB2022
11.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-SP 1	Red Coloured Solvent Removable Penetrant	JUL2024
12.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKC-1	Solvent Cleaner	JUL2024
13.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKD-S2	Solvent Base Developer	JUL2024
14.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-WP2	Red Coloured Water Washable Penetrant	JUL2024
15.	MAGNAFLUX ITW INDIA PVT.LTD.SECUNDERABAD	SKL-SP2	Red Coloured Solvent Removable Penetrant.	JUL2024
16.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 62	Solvent Removable Penetrant-Red	JAN2021
17.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 68 NF	Solvent Removable and Water Washable Penetrant-Red	JAN2021
18.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 67	Solvent Removable and Water Washable Penetrant-Red	JAN2021
19.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 672 F	Solvent Removable and Water Washable Penetrant-Fluorescent	JAN2021
20.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 85	Solvent Remover suitable for MR <sup>®</sup> 68NF, MR <sup>®</sup> 67, MR <sup>®</sup> 672F and MR <sup>®</sup> 62.	JAN2021
21.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 70	Non-Aqueous Developer suitable for MR <sup>®</sup> 68 NF, MR <sup>®</sup> 67 and MR <sup>®</sup> 672F	JAN2021

Sr. No.	Manufacturers	Brand name	Description	Valid up to
22.	MR CHEMIE INDIA PVT. LTD., HYDERABAD.	MR <sup>®</sup> 70 I	Non-Aqueous Developer suitable for MR <sup>®</sup> 62.	JAN2021
23.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-15/PP-15B	Red Coloured Solvent Removable Penetrant	SEPT2021
24.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-19/PP-19B	Red Coloured Water Washable Penetrant	SEPT2021
25.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PC-21/PC-21B	Solvent Cleaner	SEPT2021
26.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PD-31/PD-31B	Solvent Base Developer	SEPT2021
27.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PP-110/ PP110B	Red Coloured Solvent Removable Penetrant	SEPT2021
28.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PC 120/ PC-120B	Solvent Cleaner	SEPT2021
29.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	PD 130 /PD-130B	Solvent Base Developer	SEPT2021
30.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	FPS46/FPS46B	Solvent Removable Fluorescent Penetrant	SEPT2021
31.	P-MET HIGH TECH CO. PVT. LTD., VADODARA	FPS49/FPS49B	Water Washable Fluorescent Penetrant	SEPT2021
32.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Penetrant (NP Grade)	Red Coloured Solvent Removable Penetrant.	OCT2024
33.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Cleaner (NP Grade)	Solvent Cleaner	OCT2024
34.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Developer (NP Grade)	Solvent Base Developer	OCT2024
35.	PRADEEP METAL TREATMENT CHEMICALS PVT. LTD., THANE	Flaw Guide Red Dye Penetrant-W	Water Washable Dye Penetrant	OCT2024

Note:-

1. Halogen content in Penetrant, Cleaner and Developer is 25ppm (max) and Sulphur content is 500ppm (max). However when using penetrant materials for Austenitic Stainless Steel, Titanium, Nickel base or other high temperature alloys, Halogen and Sulphur content shall not exceed 25ppm. Manufacture has to mention for each batch, the Sulphur and Halogen content in the label of each container for selection of Penetrant materials for the stated application.
2. Developer is to be used in Aerosol can to get the best results.

*(Signature)*  
17/12/19

(Anoop Singh)  
ACE & Head QA (M-6)

Through: Shri A.K. Singh, AD (QA- Opns. & Group-1)

*(Signature)*  
17/12/19

*(Signature)*  
17/12/19

Executive Director (QA)

*(Signature)*  
17.12.19

Sr. No.	QA unit	Test Lab.	Suitable for material testing		
			Physical	Chemical	Micro
1	Noida	M/s R.K. Inspection & Testing Services C-42, Manak Vihar Ext.(Tihar), Subhash Nagar, New Delhi-110018. Phone no. 011 -28122201 Fax No. 011-25122517 E mail-info@rkits.co.in	<b>1. 0 Physical Testing</b>  1.1 Tensile testing at room temp. with extensometer  1.2 Impact testing as per ASTM E-23 standard  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Fillet test.	<b>2.0 Chemical Testing -</b> *2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.
2	Noida	M/s SPECTRO E-41, Okhla Indl. Area, Phase-II, New Delhi-110020 Phone no. 011 -40522000 Fax No. 011-40503150 E mail-kd@spectro.in	<b>1. 0 Physical Testing</b>  1.1 Tensile testing at room temp.  1.2 Tensile testing at elevated temp. subject to availability of extensometer for 0.2% yield stress measurement.  1.3 Impact testing testing as per ASTM E-23 standard  1.4 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.5 Bend test, Flattening, Flaring, Proof load, Pull out load, Fillet test.	<b>2.0 Chemical Testing</b>  2.1 Wet Analysis  2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement

3	Noida	M/s IRC Engg. Services.India (P) Ltd. A-53,Sector-63, Noida, District : G.B.Nagar Phone no. 0120 -3352706 Fax No. 0120-4227940 E mail-	<b>1. 0 Physical Testing</b>  *1.1 Tensile testing at room & elevated temp subject to availability of extensometer for 0.2% yield stress measurement.  1.2 Impact testing as per ASTM-E-23 standard  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.4 Bend test, Flattening, Flaring, Proof load, Creep test, Stress rupture test, Pull out load, Fillet test.	<b>2.0 Chemical Testing -</b> ** 2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.
4	Noida	M/s Inspection & Testing Engg., D-155,Sector-49. Noida, District :G.B.Nagar (UP), Pin-201 307 Phone no. 0120 -2500065 Fax No. 0120-4310675 E mail-	<b>1. 0 Physical Testing</b>  1.1 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.2 Bend test, Flattening	<b>2.0 Chemical Testing</b>  * 2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  - Nil

5	Kolkata	M/s Metals& Minerals Testing Laboratories 30/A, Naraasingha Dutta Road, Howrah-711101 Kolkata-26 Phone no. 033 26673185 Fax No. 033 26779422 E mail-	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness)  1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt & Fillet test.	<b>2.0 Chemical Testing</b>  * 2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A , Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement
6	Kolkata	M/s Aglow Quality Control Laboratories Pvt.Ltd. P 47,Kasba Industrial Estate,Kolkatta-107 Phone no. 033 40089633 Fax No. 033 40625177 E mail-	<b>1.0 Physical Testing</b>  1.1 For Rubber Testing : Tensile, Hardness, elongation, adhesion, Tension & compression, abrasion, flexing, load deflection, hydro testing, aging.	<b>2.0 Chemical Testing</b>  2.1 For Rubber Testing: Rubber polymer content, hydrocarbon Content, neoprene rubber, identification of rubber, resistance to oil, density, analysis of ash.  2.2 Painting related tests(Abrasion, cohesion , adhesion , impact resistance, % elongation, etc.)	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 Not Application

7	Kolkata	M/s ID & RL Pvt. Ltd. 33/2A,atish Mukherjee Road, Kolkatta-26 Phone no. 033 24644527 Fax No. 033 24644812 E mail-	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt & Fillet test.	<b>2.0 Chemical Testing</b>  2.1 Wet Analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement
8	Kolkata	M/s Inspection Survey & Surveillance (India) Pvt. Ltd. 26D/27,Park Lane, Kolkatta-16 Phone no. 033 65454984 Fax No. 033 22297658 E mail- insurveylab@yahoo.com	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams)  1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.,	<b>2.0 Chemical Testing</b>  * 2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement
9	Kolkata	M/s TREATS, 14,Ramnath Pal Road, Kidderpore Kolkata-23 Phone no. 033 24584142 Fax No. 033 2495818 E mail-	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Rockwell, Microhardness up to 1000 grams)	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis.	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.

			1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.		3.2 Mass of zinc coating 3.3 Paint thickness measurement
10	Mumbai	M/s. TCR Engg. Services Pvt.Ltd., EL-182,TTC Ind.Area,Mahape, Vashi, Navi-Mumbai - 400 705, (India). Phone no- 27610921/22/23 Fax no.- 2761 2044 Email- <a href="mailto:sales@tceng.com">sales@tceng.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams.  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld ,Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth Measurement, ferrite content measurement  3.2 Mass of zinc coating
11	Mumbai	M/s. Subodh Technologiists R-874, M.I.D.C.,Rabale , Navi Mumbai - 400 701. Phone no- 27690817 Fax no.- 27690817 Email- <a href="mailto:sudhakar@subodhlabs.com">sudhakar@subodhlabs.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness up to 1000 grams  1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test.	<b>2.0 Chemical Testing</b>  * 2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating,  3.2 Mass of zinc coating
12	Mumbai	M/s Geo Chem Laboratories Pvt Ltd., (Mumbai) 36, Raja Industrial Estate, Purushottam Kheraj Marg, Mulund (W), Mumbai 400 080. Phone no- 67974999 Fax no.- 67974616 Email-	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell)  1.3 Bend Test, Flattening, Flarring,	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Case depth Measurement, Micro, Macro  3.2 Mass of zinc coating

		<a href="mailto:laboratory@geochemgroup.com">laboratory@geochemgroup.com</a>	Proof Load for nuts		
13	Mumbai	M/s. Jewel Metallochem Laboratory Pvt. Ltd., A-12, Ghatkopar Indl. Estate, Ghatkopar (W), Mumbai 400 086. Phone no. 25007745 Fax No. 25001263 E mail- <a href="mailto:info@jewelmetalchem.com">info@jewelmetalchem.com</a> <a href="mailto:jewelmetal@rediffmail.com">jewelmetal@rediffmail.com</a> <a href="http://www.jewelmetalchem.com">www.jewelmetalchem.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickers, Rockwell, Microhardness 50 to 1000 grams.  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating
14	Mumbai	M/s. Metallurgical Services, Mehta House, Ashok Silk Mills Lane, L.B.S. Marg, Ghatkopar (W), Mumbai 400 086. Phone no. 25000240 Fax No. 25001740 E mail- <a href="mailto:info@metallurgicallab.com">info@metallurgicallab.com</a> <a href="mailto:metallurgicalservices@gmail.com">metallurgicalservices@gmail.com</a> <a href="http://www.metallurgicallab.com">www.metallurgicallab.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room & elevated temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickers, Rockwell, Microhardness 50 to 1000 gm  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Creep test, Fracture toughness and stress rupture test, Reverse bend test , Fatigue test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement, ferrite content measurement  3.2 Mass of zinc coating

15-A	Mumbai	M/s Elca Laboratories Plot No.A-444, Road No.37, (Off Road No.28) Near Rubber Products, Wagle Estate, Thane – 400 094. Phone no. 25824499 Fax No. 25825394 E mail- <a href="mailto:info@elcalabs.com">info@elcalabs.com</a> <a href="http://www.elcalabs.com">www.elcalabs.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickers, Rockwell, Microhardness 50 to 1000 grams.  1.3 Bend test, Flattening, Flaring, Proof load for nuts, Pull out load, Fillet test.	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A & E, Micro, Macro  3.2 Mass of zinc coating
15-B	Mumbai	Elca Laboratories, Unit-II, W-361, TTC Industrial Area, MIDC, Rabale, Navi Mumbai- 400701 25824499 25822047 25823142 25833410 Fax No. 25825394 E mail- <a href="mailto:rabale@elcalabs.com">rabale@elcalabs.com</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer  1.2 Impact testing  1.3 Hardness test (Brinell, Vickers, Rockwell, Microhardness.  1.4 Bend test, Flattening, Flaring, Proof load for nuts, Pull out load, Fillet test.	<b>2.0 Chemical Testing</b>  2.1 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A
16	Mumbai	M/s Metal Analysis & Services Pvt.Ltd., 219, Bussa Udyog Bhavan, Tokersey Jivraj Road, Sewree (W), Mumbai 400 015. Phone no. 24131160 Fax No. 66624514 E mail- <a href="mailto:hmj@bom7.vsnl.net.in">hmj@bom7.vsnl.net.in</a>	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickers, Rockwell, Microhardness upto 1000 grams.  1.3 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro  3.2 Mass of zinc coating
17	Mumbai	M/s Offshore Testing &	<b>1.0 Physical Testing</b>	<b>2.0 Chemical Testing</b>	<b>3.0 Corrosion Test &amp; Micro</b>

		<p>Inspection Services (India) Pvt .Ltd., W-147, M.I.D.C., Pawane, Thane Belapur Road, Navi-Mumbai 400 710. Tel. 022 4144414 /15/16/17</p> <p>Fax : 022 27633982 /25560401</p>	<p>1.1 Tensile testing at room temp with extensometer.</p> <p>1.2 Impact test as per ASTM E-23 Standard.</p> <p>1.3 Hardness test (Brinell, Vickess, Rockwell)</p> <p>1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test</p>	<p>2.1 Wet analysis</p> <p>* 2.2 Spectrometer analysis</p>	<p><b>Examination</b></p> <p>3.1 IGC practice A &amp; E</p>
18	Mumbai	<p>M/s Reliable Testing Services, Unit Number 59, 2<sup>nd</sup> floor, Bindal Industrial Estate, Kurla Andheri Road, Sakinaka, Mumbai 400 072. Phone no. 28516406 Fax No. 42154942 E mail- <a href="mailto:reliable1983@rediffmail.com">reliable1983@rediffmail.com</a> <a href="http://www.reliabletestingservices.com">www.reliabletestingservices.com</a></p>	<p><b>1.0 Physical Testing</b></p> <p>1.1 Tensile testing at room temp with extensometer.</p>	<p><b>2.0 Chemical Testing</b></p> <p>2.1 Spectrometer analysis</p>	<p><b>3.0 Corrosion Test &amp; Micro Examination</b></p> <p>3.1 Mass of zinc coating</p> <p>3.2 IGC practice A &amp; E</p>

19	Mumbai	M/s. Soham Analytical Services, A-121/101, B33/35, Amargian Industrial Estate, Pokhran Road No.1, Khopoli, Thane (W), Maharashtra. Tel. 022-25471297/93/94 Fax : 022 25471295 Email : lab_support@sohmanalytical.com	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness)  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld, Fillet test, Reverse bend test, Through thickness tensile test, Nick break test (pipes), Compression test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A & E, Micro, Macro, Inclusion rating, Case depth Measurement, Ferrite content  3.2 Mass of zinc coating  3.3 Hydrogen Induced corrosion test, Ferrite Chloride pitting & crevice corrosion test
20	Chennai	M/s Chennai Mettlex Lab P.Ltd. Jyothi Complex, No.83, M .K.N.Road, Guindy , Chennai – 600 032 Ph. 044-22323163, 42179490/91 Fax :044-43534270 email address test@mettlexlab.com	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with and without extensometer.  ** 1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickess, Rockwell) and Microhardness  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test  1.5 Tensile testing of rubber material	<b>2.0 Chemical Testing</b>  * 2.1 Spectrometer analysis  2.2 Polymer identification (rubber)	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating

21	Chennai	M/s Micro Lab, SP.101, 2 nd Main Road , Ambattur Industrial Estate, Chennai – 600 058 Ph. 044-26242525, Fax :044-26244872 E mail: cre@micrilabchennai.com	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with and without extensometer.  1.2 Tensile testing at elevated temp with and without extensometer.  1.3 Impact test as per ASTM E-23 Standard.  1.4 Hardness test (Brinell, Vickess, Rockwell) and Microhardness  1.5 Bend test, Flattening, Flaring, Proof load, Pull out load, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Spectrometer analysis (OES)	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating
22	Chennai	M/s. Commando Lab No. 3A 5 <sup>th</sup> South Street, Avarampalayam, Coimbatore 641 006 Phone : 0422 2560907	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer as applicable. 1.2 Hardness test (Brinell,, Vickers, Rockwell) 1.3 Bend test, Reverse bend test, Flattening test, Flaring test, Proof load test, Pull out load test.		

23	Bangaluru	M/s Geological and Metallurgical Laboratories (GML) 105X, 3rd Main, 3rd Cross, II Stage, Yeshwanthpur Indl. Suburb, Goraguntepalya, BANGALORE - 560 022 Ph. 2347 1065 , 2347 2020 Fax 2347 1011	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams.  1.3 Bend test, Flattening, Flaring , Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis.	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement
24	Baroda	M/s Met Heat Engineers Pvt. Ltd, Vadodara 857/2,G.I.D.C. Industrial Estate, Makarpura , Vadodara -390 010 Ph. (0265)2643655, 3046493, 6548715-16 Fax  email address: info@metheat.com	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams.  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement

25	Baroda	M/s TCR Advanced Engineering Pvt. Ltd. , 36/2/9, First Floor, Abhishek Complex, GIDC Estate, Makarpura, Vadodara-390 010  Ph. 0265 2657233, 2634375 Fax 0265 2643024  email address	<b>1.0 Physical Testing</b>  1.1 Tensile testing at room temp with extensometer.  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness test (Brinell, Vickess, Rockwell, Microhardness upto 1000 grams.  1.4 Bend test, Flattening, Flaring, Proof load, Pull out load, Butt weld Fillet test, Reverse bend test	<b>2.0 Chemical Testing</b>  2.1 Wet analysis  * 2.2 Spectrometer analysis	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC practice A &E, Micro, Macro, Inclusion rating, Case depth measurement.  3.2 Mass of zinc coating  3.3 Paint thickness measurement
26	Pune	M/s Elca Quality Systems & Calibration Pvt.Ltd. S.Np. 232/2, Pune Nasik Road, Bhosari, Pune 411 039. Phone no.-020 27129194, 27125024 e-mail- qc@elcalabs.com	<b>1.0 Physical Testing</b>  1.1 Cold/Hot tensile  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness/Bend/Flattening etc.	<b>2.0 Chemical Testing</b>  2.1 Spectro  2.2 Wet	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC  3.2 Micro/Macro  3.3 Coating thickness etc.
27	Pune	M/s Perfect Laboratory Services, 58,59/13,14/Unit 2 DII Block, MIDC, Chinchwad, Pune 411 019. Phone no.-020 27458150, 27454716 e-mail- trust_perfectlab@yahoo.com	<b>1.0 Physical Testing</b>  1.1 Room temperature Tensile testing  1.2 Impact test as per ASTM E-23 Standard.  1.3 Hardness/Bend/Flattening etc.	<b>2.0 Chemical Testing</b>  2.1 Spectro  2.2 Wet	<b>3.0 Corrosion Test &amp; Micro Examination</b>  3.1 IGC  3.2 Micro/Macro  3.3 Coating thickness etc.

28	Hyderabad	<p>M/s. Jyothi Spectro Analysis (P) Ltd., A-30, APIE, Balanagar, Hyderabad 500 037.</p> <p>Tel. No. 040- 23771193 23771194 23773676 23778042 E-mail : sdsingh@jyothispectro.com</p>	<p><b>1.0 Physical Testing :</b></p> <p>1.1 Hardness test (Brinell, Vickers, Rockwell)</p> <p>1.2 Bend test, Flattening, Flaring, Pull out load, Proof load test and Fillet test.</p>	<p><b>2.0 Chemical testing</b></p> <p>2.1 Spectrometer analysis for low carbon, alloy steels, ASS and aluminium bronze.</p>	<p><b>3.0 Corrosion Test &amp; Micro Examination</b></p> <p>3.1 IGC Practice A&amp;E, Micro, macro, Inclusion rating.</p> <p>3.2 Mass of zinc coating.</p>
29	Hyderabad	<p>M/s. Lucid Laboratories (P) Ltd., B-1/A, TIE, Phase II, Balanagar, Hyderabad 500 037.</p> <p>Te. No. 040-23720678 23720680 23720681 23720406 E-mail : <a href="mailto:info@lucidlabsindia.com">info@lucidlabsindia.com</a> lucidlabs@rediffmail.com</p>	<p><b>1.0 Physical Testing :</b></p> <p>1.1 Hardness test (Vickers, Rockwell)</p> <p>1.2 Bend test, Flattening and Fillet test.</p>	<p><b>2.0 Chemical testing</b></p> <p>2.1 Spectrometer analysis for low carbon, alloy steels and ASS</p>	<p><b>3.0 Corrosion Test &amp; Micro Examination</b></p> <p>3.1 Mass of zinc coating.</p>

## **Annexure - VII**

### **Technical specification for Grit Blasting & supply and application of Painting**

## **GRIT BLASTING AND PAINTING**

### **1.0 Scope**

This specification defines the requirements for Surface preparation, Grit blasting, supply, application of Paint coating on Pipes, Pipe Fittings, Valves, and all their Support structures of piping and equipments.

### **2.0 Grit Blasting and Primer Application:**

Pipelines/equipments and supporting elements should be grit blasted to the surface profile of 35-65 microns or as recommended in paint manufacturers datasheet. Mill scale, rust, rust scale and foreign matter shall be removed fully by blast cleaning and the blasted surface shall be clean and free from any scale or rust and must show a grey white metallic luster.

The blast cleaned surface shall be coated with one complete application of primer of Inorganic Zinc Silicate primer of minimum 75 microns dry film thickness (DFT) as soon as practicable but not later than 4 hrs from completion of grit blasting.

### **3.0 Low Temperature Application:**

Pipelines, supports, structural sections and equipments subjected to temperature less than 50<sup>0</sup>C ( $\leq 50^0\text{C}$ ) are coated with 2 coats (each coat of 100 microns DFT) of low temperature paints with 200 microns dry film thickness (DFT). The paints are applied after surface cleaning of primer coated surface with soft brush and cloth for removing all deposited dust, oil and grease etc. The finish coat of 50 micron is applied over the first coat.

**Paints for Low temperature application (T≤50°C)**

Type of coating	Approved Paints	Approved Brand	Application method	Minimum number of Coating	Minimum Dry Film Thickness in microns (DFT)	preparation of surface
First coat	INTERSEAL 670 HS	Akzo Noble	As recommended by paint manufacturer	2 (per coat 100 Micron)	200	After Dust cleaning of primer coated surface.
	Or PROTECTOMASTIC	Berger				
	Or RUST-O-CAP	Asian Paints				
	Or NPCIL approved equivalents					
Finish coat	INTERGARD – 740	Akzo Noble	As recommended by paint manufacturer	1 coat 50 Micron	50	After Dust cleaning of coated surface.
	Or EPILUX155 or EPILUX 89 HB	Berger				
	Or APCODUR CF 693 LX	Asian Paints				
	Or NPCIL approved equivalents					

**4.0 Medium Temperature Application:**

Pipelines, supports, structural sections and equipments subjected to temperature range  $50 < t \leq 150^{\circ}\text{C}$  are coated with 2 coats of medium temperature

paints with dry film thickness(DFT) as mentioned in table below. The paints are applied after surface cleaning of primer coated surface. Only pipe/equipment supports like saddle, shoe, clamps that comes in contact with pipeline/equipment and are subjected to pipeline temperature range  $50 < t \leq 150^{\circ}\text{C}$ , should be coated with medium temperature paint. Other supporting elements that subjected to  $t < 50^{\circ}\text{C}$  should be coated with low temperature paint.

**Paints for Medium temperature application ( $50 < t \leq 150^{\circ}\text{C}$ )**

Type of coating	Approved Paints	Approved Brand	Application method	Minimum number of Coating	Minimum Dry Film Thickness in microns (DFT)	preparation of surface
Finish coat	INTERPLUS– 256	Akzo Noble	As recommended by paint manufacturer	2 (per coat 75 Micron)	150	After Dust cleaning of primer coated surface.
	Or FERROTOL HR ALUMINUM PAINT	Berger		2 (per coat 25 Micron)	50	
	Or RUST-O-CAP MIO	Asian Paints		2 (per coat 75 Micron)	150	
	Or NPCIL approved equivalents					

**5.0 High Temperature Application:**

Pipelines, supports, structural sections and equipments subjected to temperature range  $t > 150^{\circ}\text{C}$  are coated with 2 coats of High temperature paints with dry film thickness(DFT) as mentioned in table below. The paint are applied after surface cleaning of primer coated surface. Only pipe/equipment supports

like saddle, shoe, clamps that comes in contact with pipeline /equipment and are subjected to pipeline temperature i.e,  $t > 150^{\circ}\text{C}$  ,should be coated with high temperature paint. Other supporting elements that subjected to  $t < 50^{\circ}\text{C}$  should be coated with low temperature paint.

**Paints for High temperature application ( $t > 150^{\circ}\text{C}$ )**

Type of coating	Approved Paints	Approved Brand	Application method	Minimum number of Coating	Minimum Dry Film Thickness in microns (DFT)	preparation of surface
Finish coat	INTERTHERM – 50	Akzo Noble	As recommended by paint manufacturer	2 (per coat 25 Micron)	50	After Dust cleaning of primer coated surface.
	Or CORROHEAT ALUMINUM	Berger				
	Or HEAT RESISTING SILICONE ALUMINUM PAINT	Asian Paints				
	or NPCIL approved equivalents					

**6.0 Requirements for Grit blasting:**

1. The minimum acceptable standard for blast cleaning is Sa 2-½ as per Swedish Standard SIS-05 5900 (latest edition) or SSPC or ISO 8501-01.
2. In case manual or hand tool cleaning shall be St. 2 or equivalent, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent.
3. Before blast cleaning, visible deposits of oil, grease, or other contaminants

shall be removed and clean, dry compressed air shall be used for nozzle blasting.

4. The surfaces shall be blast cleaned using one of the abrasives like chilled cast iron or malleable iron, shall be in the form of shot or grit of size GP25/GP16 (G42 grade maximum) and S250 grade size of steel shots (maximum) to obtain a desired surface profile. The combination of steel grits and shots shall be normally in the ratio of 3:1.
5. The quality of abrasives shall be free from contaminants and impurities and shall meet the requirements of SSPC AB1.
6. Power tool cleaning shall be done only where blast cleaning is not possible like site weld joints of erected pipeline, structures etc. It involves cleaning by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes.

#### **7.0 Requirements for paint application:**

1. Airless spray /conventional air spray/brush/roller as recommended by paint manufacturer should be used for primer/paint application.
2. The paints used for first coat, intermediate and finish coats shall be from the same manufacturer and shall be compatible as per the manufacturers data sheet.
3. Unused and left over paints shall be immediately removed from the site, at the end of the each day and shall be disposed off properly.
4. Paint components such as base, epoxy, curing agents once mixed shall be consumed within the pot life period and also validity expired paints shall not be used for application.
5. Paint application by brush shall be used for touch up painting such as site weld joints.
6. Surface shall not be coated in rain, wind or in environment and when the steel surface temperature is less than 5°F above dew point when the relative humidity is greater than 85% or when the temperature is below 40°F and when the ambient/substrate temperature is below the paint

manufacturer's recommended temperature for application and curing.

7. Each coat shall be in proper state of cure or dryness before the application of succeeding coat. No coat shall be applied until the preceding coat has dried.
8. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer's instruction shall be followed for inter coat interval.
9. 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.
10. To the maximum extent practicable, each coat of material shall be applied as a continuous film of uniform thickness.
11. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.
12. The painting equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges.
13. Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.
14. Paint shall be applied in a uniform layer and spray patterns shall be adjusted so that the paint is deposited uniformly.
15. No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.
16. Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.
17. Where paint has been damaged in handling and in transportation, the repair of damaged coating should be cleaned by mechanical scraping or

grinding wheels or rotating steel wire-brushes and inorganic zinc silicate and subsequent coats shall be applied.

#### **8.0 Testing:**

1. Material test certificate as per the IS or relevant standards shall be submitted along the material supply for acceptance.
2. The cleaned surface shall be inspected visually and using press-o-film for the required roughness for application of the primer / paint coating.
3. The existing coated surface with paint/primer shall be inspected after surface cleaning visually for absence of any dust, oil or grease.
4. The applied paint coats shall be examined for its specified coating thickness (DFT) by the latest and NPCIL approved measuring instruments.
5. Adhesion test or any other relevant test shall be conducted at site on coated surface for verification as per relevant standards (ASTM D-3359, ASTM D3363) as per the instruction of NPCIL.

#### **9.0 Color Coding:**

The color of paint required for the major systems are furnished below.

Sl. no.	System/ Description	Ground Colour
1	Cooling water system (PGB)	French Blue
2	Ordinary (Raw) water	Grass Green
3	Domestic or Drinking water	Grass Green
4	Domestic hot water	Grass Green
5	De-mineralized water	French Blue
6	Condenser cooling water (Sea water) (PAB)	Oriental Blue
7	Sea water for normal loads	Oriental Blue
8	Condensate system water	Sky Blue
9	Boiler feed water	Sky Blue
10	Re heater return	Sky Blue
11	Fire fighting water	Signal Red

12	Drainage system (Inactive)	Black
13	Steam systems	Aluminium
14	Compressed Air (Instrument & Service)	White
15	Compressed gases	White
16	Vacuum system	White
17	Turbine oil systems	Light Brown
18	Acids	Light purple brown
19	Alkali	Light salmon pink
20	Hydrazine, Ammonia, Chemical waste	Lemon
21	Turbine & Generator	Orange

#### 10.0 **Reference standards/codes:**

IS 101 - Methods of test for ready mixed paints and enamels.

IS 1200- for measurement of painted surface

ASTM D 1005 – 95 Standard Test Method for Measurement of Dry-Film thickness of Organic Coatings Using Micrometers.

ASTM D-3359-Standard Test Methods for Measuring Adhesion by Tape Test

ASTM D3363-Standard Test Method for Film Hardness by Pencil Test

#### 11.0 **Measurement of finished area:**

Measurement of the finished painted area of the valves, Pipe Flange and Spring hanger of pipe support shall be as per the following methodology.

##### 1. Valve:

The quantity of valves shall be measured in terms of numbers referred to the pipe outside diameter. The term valves shall be deemed to include all flanged component (all type of valves, sight glasses, strainers, level indicators, steam traps) irrespective of pressure rating and their installed length and including operating elements (hand wheels, levers). Valves with welding ends and threaded ends shall be considered as 0.8 piece. A valve up to size DN 50 shall be considered as straight pipe length of 1 m and a valve size above DN 50 shall

be considered as straight pipe length of 2 m of corresponding pipe size. This additional measurement is in addition to the total length of pipeline including the valve body.

## 2. Flange:

The surface area of flange or blind flange shall be measured as a straight pipe length of 0.3 m of the corresponding pipe size of all pressure rating and type of flanges. This 0.3 m is in addition to the total length of pipe includes the flange length. The surface area of a flange is derived as  $A = \pi DL$ , where,  $D$ =Outer diameter of the pipeline (m) &  $L = 0.3\text{mtr}$ .

## 3. Spring hanger of pipe support:

The surface area of spring hanger of a pipe support for any size of pipe line and of any size of spring hanger support shall be measured as  $A = \pi DL$ , considering  $\pi D = 0.2\text{ m}$  multiplied by the actual length  $L$  of spring hanger support. The area measured by this method of spring hanger support, including the area of EP, support plate, upper tie rod, spring assembly and lower tie rod. The area of bottom channel of spring hanger support is taken separately.

Annexure-VII (Rev.1)

Technical specification for Grit Blasting & supply and application of Painting

**CONTENT**

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## **GRIT BLASTING AND PAINTING**

### **1.0 Scope**

This specification covers the general requirements for grit blasting and painting. For detailed specification of surface preparation, grit blasting, product qualification, supply, application, inspection & testing of paint coating on Pipes, Pipe Fittings, Valves, equipments, supports, structures shall as per as per I02.KK34.0.0.TH.TS.PR0017 attached.

### **2.0 Requirements for Grit blasting:**

1. The minimum acceptable standard for blast cleaning is Sa 2-½ as per ISO 8501-01.
2. In case manual or hand tool cleaning shall be St. 2 or equivalent, in case of mechanical or power tool cleaning it shall be St. 3 or equivalent.
3. Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed and clean, dry compressed air shall be used for nozzle blasting.
4. The surfaces shall be blast cleaned using one of the abrasives like chilled cast iron or malleable iron, shall be in the form of shot or grit of size GP25/GP16 (G42 grade maximum) and S250 grade size of steel shots (maximum) to obtain a desired surface profile. The combination of steel grits and shots shall be normally in the ratio of 3:1.
5. Power tool cleaning shall be done only where blast cleaning is not possible like site weld joints of erected pipeline, structures etc. It involves cleaning by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes.

### **3.0 Requirements for paint application:**

1. Supports elements like saddle, shoe, clamps that comes in contact with pipeline/equipment and which are subjected to pipeline temperature range  $50 < t \leq 300^{\circ}\text{C}$ , should be coated with medium or high temperature paint. Other supporting elements that subjected to  $t < 50^{\circ}\text{C}$  should be coated with low temperature paint.
2. Airless spray /conventional air spray/brush/roller as recommended by paint manufacturer should be used for primer/paint application.
3. The paints used for first coat, intermediate and finish coats shall be from the same manufacturer and shall be compatible as per the manufacturers data

sheet.

4. Unused and left over paints shall be immediately removed from the site, at the end of the each day and shall be disposed off properly.
5. Paint components such as base, epoxy, curing agents once mixed shall be consumed within the pot life period and also validity expired paints shall not be used for application.
6. Paint application by brush shall be used for touch up painting such as site weld joints.
7. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer's instruction shall be followed for inter coat interval.
8. 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.
9. To the maximum extent practicable, each coat of material shall be applied as a continuous film of uniform thickness.
10. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.
11. The painting equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges.
12. Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.
13. Paint shall be applied in a uniform layer and spray patterns shall be adjusted so that the paint is deposited uniformly.
14. No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.
15. Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.
16. Where paint has been damaged in handling and in transportation, the repair of damaged coating should be cleaned by mechanical scraping or grinding

wheels or rotating steel wire-brushes and **same primer** and subsequent coats shall be applied.

#### **4.0 Color Coding:**

The tentative color of paint required for the major systems are furnished below. However actual and final colour of paints to be used will be provided to the successful bidder(contractor) during the execution of work.

Sl. no.	System/ Description	Ground Colour
1	Cooling water system (PGB)	French Blue
2	Ordinary (Raw) water	Grass Green
3	Domestic or Drinking water	Grass Green
4	Domestic hot water	Grass Green
5	De-mineralized water	French Blue
6	Condenser cooling water (Sea water) (PAB)	Oriental Blue
7	Sea water for normal loads	Oriental Blue
8	Condensate system water	Sky Blue
9	Boiler feed water	Sky Blue
10	Re heater return	Sky Blue
11	Fire fighting water	Signal Red
12	Drainage system (Inactive)	Black
13	Steam systems	Aluminium
14	Compressed Air (Instrument & Service)	White
15	Compressed gases	White
16	Vacuum system	White
17	Turbine oil systems	Light Brown
18	Acids	Light purple brown
19	Alkali	Light salmon pink
20	Hydrazine, Ammonia, Chemical waste	Lemon
21	Turbine & Generator	Orange

#### **5.0 Measurement of finished area:**

Measurement of the finished painted area of the valves, Pipe Flange and Spring hanger of pipe support shall be as per the following methodology.

##### **1. Valve:**

The quantity of valves shall be measured in terms of numbers referred to the pipe outside diameter. The term valves shall be deemed to include all flanged component (all type of valves, sight glasses, strainers, level indicators, steam

traps) irrespective of pressure rating and their installed length and including operating elements (hand wheels, levers). Valves with welding ends and threaded ends shall be considered as 0.8 piece. A valve up to size DN 50 shall be considered as straight pipe length of 1 m and a valve size above DN 50 shall be considered as straight pipe length of 2 m of corresponding pipe size. This additional measurement is in addition to the total length of pipeline including the valve body.

## 2. Flange:

The surface area of flange or blind flange shall be measured as a straight pipe length of 0.3 m of the corresponding pipe size of all pressure rating and type of flanges. This 0.3 m is in addition to the total length of pipe includes the flange length. The surface area of a flange is derived as  $A = \pi DL$ , where, D=Outer diameter of the pipeline (m) & L= 0.3mtr.

## 3. Spring hanger of pipe support:

The surface area of spring hanger of a pipe support for any size of pipe line and of any size of spring hanger support shall be measured as  $A = \pi DL$ , considering  $\pi D = 0.2$  m multiplied by the actual length L of spring hanger support. The area measured by this method of spring hanger support, including the area of EP, support plate, upper tie rod, spring assembly and lower tie rod. The area of bottom channel of spring hanger support is taken separately.

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NUCLEAR POWER CORPORATION OF INDIA LIMITED  
(A Government of India Enterprise)

KUDANKULAM NUCLEAR POWER PROJECT-3&4



TECHNICAL SPECIFICATION  
FOR  
PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS  
AREA ( NON RADIOACTIVE)

Number of the Document	102	KK34	0	0	TH	TS	PR017
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Title	Total Number of Pages	Date	Revision Number
TECHNICAL SPECIFICATION FOR PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS ( NON RADIOACTIVE) AREA	40	Sept, 2018	1

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NUCLEAR POWER CORPORATION OF INDIA LTD.  
(A Government of India Enterprise)

2 X 1000 MWe KUDANKULAM NUCLEAR POWER PROJECT  
UNITS -3&4

DOCUMENT NO.: I02.KK34.0.0.TH.TS.PR017

TECHNICAL SPECIFICATION  
FOR  
PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS  
(NON RADIOACTIVE) AREA

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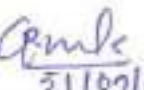


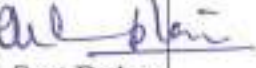


### REVISION CONTROL SHEET

DOCUMENT TYPE : TECHNICAL SPECIFICATION

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TITLE : TECHNICAL SPECIFICATION  
FOR PAINTING OF STRUCTURES, SYSTEMS AND  
COMPONENTS OF FREE ACCESS AREA (NON  
RADIOACTIVE)

Revision No.	Description of Revision	Revised by Name & Signature	Checked by Name & Signature	Reviewed by Name & Signature	Approved by Name & Signature
1.	Parameter related to zinc dust has been included in Table No-1 of Annex.A  Parameter related to zinc dust content in Table-2 of Annex.A	 P.C. Gaurav, EE(Engg.-LWR)	 V.H. Scaria, Sr.EE (Engg.-LWR)   R. Gurnule, DCE (Engg.-LWR)	 R. R. Sahaya, (CE -CONTT, RP&S & CFD - Engg.-LWR)   S K Sinha CE (Engg.-LWR)	 Smt Rajee Guptan (AD-PSA-Engg.-LWR)




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	<b>NUCLEAR POWER CORPORATION OF INDIA LIMITED</b> <b>KUDANKULAM NUCLEAR POWER PROJECT - 3&amp;4</b>	
<b>TECHNICAL SPECIFICATION FOR PAINTING OF STRUCTURES, SYSTEMS AND COMPONENTS OF FREE ACCESS AREA ( NON RADIOACTIVE)</b>	<b>Page No. : 6</b> <b>Rev. No. : R 01</b>	

## 1.0 SCOPE

This technical specification is intended to cover selection, supply of coating materials, coating application, inspection, testing, repair and handling of paint related work for all non-radioactive (free access) area such as UMA, UMV, UKD etc. except sea water system structures. For sea water systems & structures refer Technical Specification 102.KK34.0.0.TH.TS.PR009.

## 1.1 EXTENT OF SPECIFICATIONS

- a. All Carbon Steel Storage Tanks , pipes, ducts, support, structures.
- b. All G.I. ducts, support, structures.
- c. Painting of color bands on all piping as required for identification including insulated aluminum clad, SS, plastic or plastic coated and nonferrous piping/ equipment if any.(specification of identification and color coding to be given to the successful bidder at the time of execution of the work)
- d. Identification lettering/ numbering on all painted surfaces of equipment/piping insulated aluminum clad, SS and non-ferrous piping.
- e. Repair work of damaged pre-erection/ fabrication and shop primer and weld joints in the field/site before and after erection as required.
- f. Supply, handling, storage of all primers, paints and all other materials required for painting.

## 1.2 EXCLUSION

- a. Painting of Non-ferrous materials like aluminum, plastic material, Stainless steel and duplex steel structure until and unless specified by NPCIL.

## 2.0 COATING MATERIAL SPECIFICATION :

The coating material should be as per properties indicated in Annexure- A.



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### 3.0 REFERENCE CODES & STANDARDS

CODE /STANDRAD	TITLE
ISO 12944	Paint and varnish – corrosion protection of steel structure by protective paint system.
ISO 8501	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness
ISO 8502-3	Preparation of steel substrates before application of paints and related products – Test for the assessment of surface cleanliness – Assessment of dust on steel surfaces prepared for painting, pressure sensitive tape method.
ISO 8503	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast cleaned substrates.
ISO 8504-2	Preparation of steel substrates before application of paints and related products – Surface Preparation Methods – Abrasive blast-cleaning.
ISO 1513	Paints and varnishes – Examination and preparation samples for testing.
ISO 2808	Determination of film thickness
ISO 2409	Cross cut test.
SSPC-SP	Steel Structures Painting Council, U.S.A.
ASTM G 62-85	Standard Test Methods for Holiday Detection in Pipeline Coatings
ASTM D520	Standard Specification for Zinc Dust Pigment
ASTM D521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
IS 101	Methods of sampling and test for paints, varnishes and related products
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D 5895	Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic



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ASTM D 1200	Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D 1186	Standard Test Measurement DFT.
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM G-154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ISO 4624	Pull of test for adhesion



#### 4.0 TECHNICAL REQUIRMENT FOR PAINT APPLICATION

##### 4.1 PRE-BLASTING :

4.1.1 Scope of work include treatment of surface for application of protective coating such as removal of dust,oil/grease contamination, removal of salt deposit and other water soluble compounds.

4.1.2 The surfaces shall be free from any foreign matter such as weld flux, residue, slivers, oil, grease, salt etc. prior to blast cleaning.

##### 4.1.3 Surface preparation of Galvanized steel :

The surface shall be cleaned by using suitable detergent to remove oil and grease etc. Salt and other contamination may be removed by high pressure water cleaning. Surface must be free from zinc salt. A dull rough profile on substrate is required for paint application.

##### 4.2 BLAST CLEANING :

4.2.1 Blasting abrasives shall be dry, clean and free from contaminants which will be detrimental to the performance of the coating.

4.2.2 In case of rain or bad weather, surface preparation shall not be carried out outdoors.

4.2.3 When surface is wet, surface preparation shall not be carried out.

4.2.4 Surface preparation/Roughness profile of the cleaned surface shall conform to the paint manufacturer recommendations.

4.2.5 Substrate condition during blasting must be 3 degree Celsius above dew point temperature.

4.2.6 Irrespective of whether external or internal surface to be coated, blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceed 85%. Relative Humidity reading shall be recorded every 2 hour during the blasting operation in the immediate vicinity of operation.

4.2.7 If wet abrasive method is used for cleaning then the substrate shall be fully dried before application of any coating.

4.2.8 Compressed air used for blast cleaning shall be clean, dry and free of moisture and oil.



Moisture separators, oil separator, traps or other equipment may be necessary to achieve clean, dry air.

- 4.2.9 The maximum content of soluble impurities on the blasted surface as sampled using ISO 8502-6 and distilled water, shall not exceed a conductivity corresponding to a NaCl content of 20 mg/m<sup>2</sup>. Equivalent methods to determine salt contamination, may be used.

#### 4.3 PAINT APPLICATION :

- 4.3.1 Pre-fabrication primer is not a part of the paint system. It might need to be removed.
- 4.3.2 Paint/primer shall be applied after ensuring assessment of prepared surfaces as per ISO 8501-1 / ISO 8501-2 .
- 4.3.3 The elapsed time between the abrasive blasting of surface and coating shall not exceed the maximum as given in the following table

Relative humidity	Maximum Time elapsed
Above 80%	2.0 Hour
50% to 80%	3.0 Hour
Up to 50 %	4.0 Hour

- 4.3.4 At the end of pipe joint where welding is to take place a cut back (160 mm) may be allowed in the coating depending upon the field joint coating method selected. The actual distance if any, shall be agreed upon, prior to application.
- 4.3.5 Area not to be coated shall be masked with disposable plastic sheets, tapes, cardboards etc.
- 4.3.6 Prior to the application of each coat, a stripe coat shall be applied by brush to all welds, corners, behind angles, sharp edges of beams etc. and areas not fully reachable by spray, in order to obtain the specified coverage and thickness.
- 4.3.7 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the Steel surface temperature is less than 3° C. above dew point, when the relative humidity is greater than 85% or when the temperature is below 5 ° C
- 4.3.8 If wind speed exceed 10 km/h than proper shielding arrangement to be provided by




applicator.

- 4.3.9 All nameplates, manufacturer's identification tags, machined surfaces, instrument glass, finished flange faces, control valve items and similar items shall be masked to protect coating deposition. If these surfaces are coated, the component shall be cleaned and resorted to its original condition.
- 4.3.10 For top coating application, manufacturer's recommended over coat interval time to be followed.
- 4.3.11 No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.
- 4.3.12 Painted surface shall be protected from rain, condensation, contamination until dry to the fullest extent practicable.
- 4.3.13 The method of application shall be governed by the coating manufacturer's recommendation for the particular coating being applied.
- 4.3.14 In organic Zinc silicate primer shall not be applied below relative humidity of 65%.

## 5.0 GENERAL REQUIRMENT

- 5.1 The bidder shall provide comprehensive documentations detailing his previous experiences of using the specified coating systems. In particular this shall address internal lining of both large and small bore pipelines/ equipment's. This information shall be submitted with the bid.
- 5.2 The bidder may be required to set up a coating facilities at site complete with all necessary equipment, consumables and personnel to complete the work. The bidder is to confirm his intention to do this at the bid stage and submit details of the facility he proposes, including size of area required and utilities.
- 5.3 The bidder shall provide with his bid an inventory of the proposed equipment and personnel that will be used to execute the contract in line with the project schedule.
- 5.4 The bidder shall provide a comprehensive execution plan and methodology of coating with the proposal.
- 5.5 The bidder shall perform all work in accordance with this specification and other requirements noted herein.

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- 5.6 The bidder shall also supply along with his offer copies of test reports conducted by reputed test agencies evidencing that materials conform to minimum performance requirements attached else where in this specification.
- 5.7 The contractor will be totally responsible for field coating, field weld joint coating including testing and inspection of coated area.
- 5.8 All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipments, scaffolding materials, shot & grit blasting equipment's & air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity/nos. The manufacturer's test certificates / data sheets for all the above items shall be reviewed by NPCIL Engineer-in-charge at site before start of work.
- 5.9 Mechanical mixer shall be used for paint mixing operations, except that the NPCIL 'Engineer-In-Charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.
- 5.10 Where paint has been damaged in handling and in transportation, the repair of damaged coating of pre-erection / fabrication and Shop primer shall be done by contractor.
- 5.11 The contractor shall prepare a field weld joint coating and a repair procedure for review and approval by NPCIL Engineer-in-charge.
- 5.12 Defective work shall be rectified/repared by the contractor at his own expenses.



## **6.0 INSPECTION AND TESTING**

### **6.1 COATING PROCEDURE QUALIFICATION :**


- 6.1.1 Prior to actual application on job, sample application shall be carried out to establish that the coating operation and coating material meet the requirements of this specifications.
- 6.1.2 Quality control tests shall be performed as follows :
- Blast cleanliness standard and profile inspection.
  - Salt contamination test
  - Visual testing.
  - Thickness testing, holiday inspection, adhesion testing, curing testing as per approved standard specified in this specification.
  - Repair procedure , as approved by NPCIL
- 6.1.3 No application/production shall commence until the Contractor has performed all the above tests to complete satisfaction of NPCIL Engineer-in -charge.

### **6.2 VISUAL INSPECTION**

- 6.2.1 Assessment of the prepared surfaces shall be visually assessed as described in ISO-8501.
- 6.2.2 Testing for soluble salt and other invisible contamination on visually cleaned surface by physical and chemical method shall assessed as per ISO 8502.
- 6.2.3 The surface roughness profile accordance with paint manufacturer shall be assessed as per ISO 8503.

### **6.3 THICKNESS TESTS**

- 6.3.1 The paint thickness shall be checked using non-destructive test.
- 6.3.2 Dry Film Thickness (DFT) Meter used shall be calibrated before each inspection and shall be witnessed by the Inspector. It is the duty of the Inspector to satisfy himself with the performance of the DFT Meter.
- 6.3.3 The Dry Film Thickness (DFT), as measured in accordance with ASTM D-1186, shall not vary by 10 % of the specified value.
- 6.3.4 The Area coverage of DFT measurement is as per SSPC-PA2.

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#### **6.4 HOLIDAY DETECTION**

- 6.4.1 100% of the internally coated pipe shall be tested.
- 6.4.2 Holiday testing shall be done in accordance with ASTM G-62 after curing of paints.
- 6.4.3 No holidays are accepted and all holidays shall be repaired. The maximum repair rates allowable for holidays shall be 4 per day.

If number is exceeded, or the daily average if exceeded for any 5 consecutive days of production , then application shall cease and the cause shall be investigated and resolved.

- 6.5 **Adhesion test** is destructive test and shall be done on applied surface selected by NPCIL Engineer- in-charge, if required, as per ISO 4624 or ASTM D4541.

#### **6.6 Environment condition test.**

- 6.6.1 Following parameter to be checked
  - a. Air Temperature (Max. & Min. )
  - b. Relative humidity (Min. & Max.)
  - c. Dew Point Temperature.
  - d. Surface Temperature.
  - e. Wind Speed (Max.)
- 6.6.2 In an interval of eight hour, data to be collected and recorded in data sheet. More frequent measurement to be done if conditions are changing rapidly and will be decided by NPCIL Engineer-in-charge.
- 6.6.3 Sling Psychrometer to be used as per ASTM E337 to record wet & dry Temperature record Humidity. Alternatively, equivalent approved instrument may also be used.



## 7.0 QUALIFICATION REQUIREMENTS

### 7.1 Selection of products :

- 7.1.1 Selection of products shall be carried out based on certificate submitted by paint manufacturer as indicated in Annexure- A from an independent reputed Government lab agreed between contractor and NPCIL.
- 7.1.2 Test method mentioned in test certificate should be as per test standard mentioned in Annexure- A. However, equivalent standard other than specified in Annexure-A, may be followed subjected to NPCIL approval.
- 7.1.3 Only product approved by NPCIL as per Annexure- A shall be used for application.
- 7.1.4 Paint qualification cost, if applicable shall be borne by EPC contractor/ Paint Manufacturer.

### 7.2 Qualification of Personnel

#### 7.2.1 Qualification of paint applicator

Applicator shall be qualified to perform the task viz blast cleaning, application etc. The personnel shall have relevant knowledge of health and safety hazard, coating materials, use of protection equipment, etc.

If not qualified, personnel shall carry out a test in accordance with the standard Coating Procedure Specification. The test shall be supervised by a qualified supervisor and inspected and accepted by qualified QC personnel. A test certificate shall be issued.


The test shall be carried out on a test panel (minimum 1mt x 1 mt), 1 angle, 1 spool piece of pipe Alternatively a location providing similar geometrical complexity on the component to be coated may be used.

The acceptance criteria are the requirements to the coating system described in this document. Variation in the film thickness shall be within the limits described in this specification. Applicator failing to meet the requirements shall not be allowed to carry out work in accordance with this document.

#### 7.2.2 Qualification of procedures

Coating Procedure Specification (CPS)

Supplier shall establish a detailed CPS based on the requirements of this document.

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The CPS shall contain the following:

- Identification of equipment for surface preparation and application.
- Information given on Coating System Data Sheet.
- Personal protective equipment to be used.
- Safety data sheets for each product.

The qualified CPS shall be followed during all coating work.

The following changes in the coating application parameters requires the CPS to be requalified.

- Any change of coating material.
- Change of method and equipment for surface preparation and coating application.

## 8.0 QUALITY ASSURANCE PLAN

QAP shall be submitted by vendor according to this specification. Acceptance is subjected to NPCIL approval.



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**9.0 RECOMMENDED PROTECTIVE COATING SYSTEM.**

SL.No.	Equipment's		System recommended	DFT/coat $\mu\text{m}$	No.of coats	Detailed specifications
1.0	Pipeline					
Material – Carbon Steel						
1.1	Area - Indoor & outdoor		Polyester Glass Flake	500-550	2	Table no-5 of Ann.-A
	Fluid- Sea water					
	Application- Internal surface.		Total thickness (Min.)	1000-1100		
1.2	Area- Indoor & outdoor	Temperature < 50°C	Primer: Inorganic Zinc Silicate.	70-80	1	Table No.- 1,3,4 of Ann.-A
			Under coat: Epoxy MIO intermediate coat.	100-120	1	
			Top coat: Aliphatic Polyurethane	30	2	
			Total DFT (Min.)	230-260 $\mu$		
		Temperature up to 300°C (for under insulation paint)	Primer : Inorganic Zinc silicate	70-80	1	Table- 1,6 of Ann.-A
			Top coat : High temperature resistance silicone based ambient curing coating.	25	2	
			Total Thickness	120-130 $\mu$		



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1.3	Area- Indoor & outdoor		No coating required.				
	Fluid-DM water.						
	Application-Internal surface						
1.4	Area- Under-ground		Polyester Flake	Glass	500-550	2	Table no-5 of Ann.-A
	Application- External surface						
			Total thickness (Min.)		1000-1100		
Material – Galvanized steel.							
1.6	Area- outdoor		Under coat- Wash primer (poly vinyl butyral resin)		8-10 μ	1	Table- 3 of Ann.- A
	Application-External surface		Top Coat – Aliphatic Polyurethane		30 μ	2	
			Total (min.)	DFT	68-70 μ		
2.0	Tank						
Material- Carbon steel.							
2.1	Area- Indoor & outdoor	i). Fluid-Chemicals/ Acid	Rubber lines.				As per IS 4682
			Thickness-mm.	4.5	NA	NA	



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	<b>Application</b> n-Internal surface	<b>ii). Fluid – Diesel oil, DM water, fire water.</b>	High Build epoxy phenolic tank liner.  <b>Total thickness</b>	150 $\mu$  300 $\mu$	2	Table – 8 of Ann.-A
		<b>iii). Fluid-Potable water</b>	Polyamine cured epoxy paint approval from CFTRI Mysore.	<b>Total thickness-</b> 225-250 $\mu$	-	Table-9 of Ann.-A
<b>2.2</b>	<b>Area</b> – Indoor & outdoor  <b>Application</b> n –External surface (except bottom portion)	Temperature < 50°C	<b>Primer:</b> Inorganic Zinc Silicate. <b>Under coat:</b> Epoxy MIO intermediate coat. <b>Top coat:</b> Aliphatic Polyurethane  <b>Total DFT (Min.)</b>	70-80 $\mu$  100-120 $\mu$  30 $\mu$  230-260 $\mu$	1  1  2	Table No.- 1,3,4. Of Ann.-A
		Temperature upto 200°C (For under insulation paint. )	<b>Primer :</b> Inorganic Zinc silicate <b>Top coat :</b> High temperature resistance silicone based ambient curing coating. <b>Total Thickness</b>	70-80 $\mu$  25 $\mu$  120-130 $\mu$	1  2	Table- 1,6 of Ann.-A
<b>2.3</b>	<b>External surfaces of CS tank (soil side)</b>		Coal Tar Epoxy  <b>Total thickness (Minimum)</b>	100  200 $\mu$	2	IS 14948:2001
<b>Material- Stainless steel</b>						
<b>2.4</b>	<b>Area-</b> Indoor & outdoor  <b>Application-</b> Internal surface		No coating.			



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2.5	Area- Indoor & outdoor	For Under insulation tank	Aluminum foil.			
	Applicati on- Internal surface	Others	Not Applicable.			
3.0	Ducts.					
3.1	Material – Carbon steel.	Primer- Zinc Rich Epoxy	75-80 μ	1	Table No.-2,7 of Ann.- A	
	Area- Indoor	Top Coat- High build epoxy	125 μ	2		
	Application-External surface.	Total thickness (Minimum)	325-330 μ			
	Material – Carbon steel.	Primer- Zinc Rich Epoxy	75-80 μ	1	Table No.- 2,3,4 of Ann.-A	
	Area- outdoor	Under coat- Epoxy MIO	100-120 μ	1		
	Application-External surface.	Top Coat- Aliphatic PU	30μ	2		
		Total thickness (Minimum)	230-240 μ			



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3.2	<b>Material</b> – Galvanized Iron  <b>Area-</b> Indoor & outdoor  <b>Application-</b> External surface.	<b>Under coat-</b> Wash primer (poly butyl)  <b>Top Coat</b> – Acrylic PU  <b>Total DFT (min.)</b>	8-10 μ  30 μ  60-70 μ	1  2	Table no- 3 of Ann.-A	
4.0	<b>Metal Structures.</b>					
	<b>Material</b> - Carbon steel      <b>Area</b> – Indoor & Outdoor	Structure where SA 2.5 could be achieved.	<b>Primer:</b> Inorganic Zinc Silicate.	70-80 μ	1	Table-1,3,4 of Ann.-A
			<b>Under coat:</b> Epoxy MIO intermediate coat.	100-120 μ	1	
			<b>Top coat:</b> Aliphatic Polyurethane	30 μ	2	
		Structure where SA 2.5 could not be achieved. Forsuch structure at least St-3 is required.	<b>Total DFT (Min.)</b>	230-260μ		
		<b>Primer-</b> Zinc Rich Epoxy	75-80 μ	1	Table No.-2,3 of Ann.-A	
		<b>Top Coat-</b> Aliphatic Polyurethane	30 μ	2		
		<b>Total thickness (Minimum)</b>	135-140 μ			



5.0	Support				
5.1	Material- Carbon steel  Area – Indoor	Primer- Zinc Rich Epoxy	75-80 $\mu$	1	Table No.-2,7 of Ann.-A
		Top Coat- High build epoxy	125 $\mu$	2	
		Total thickness (Minimum)	325-330 $\mu$		
5.2	Material- Carbon steel  Area – Outdoor	Primer- Zinc Rich Epoxy	75-80 $\mu$	1	Table No.-2,3 of Ann.-A
		Top Coat- Aliphatic Polyurethane	30 $\mu$	2	
		Total thickness (Minimum)	135-140 $\mu$		
6.0	Exhaust Duct of Diesel Generator	Primer : Inorganic Zinc silicate	70-80 $\mu$	1	Table-1,6 of Ann.-A
		Top coat : High temperature resistance silicone based ambient curing coating.	25 $\mu$	2	
		Total Thickness	120-130 $\mu$		



## 10.0 PAINT DATA REQUIREMENT

### DATA TO BE FURNISHED BY THE COATING CONTRACTOR AT THE TIME OF COATING SYSTEM APPROVAL.

Sl. No.	*Parameters	Test Code (As specified according to Standard specified in the specification or equivalent)	Value / Details
1.0	<b>Coating Details</b>		
1.1	Type		
1.2	Resin		
1.3	Pigment		
1.4	Volume of Solids		
1.5	Total coating thickness to be achieved as per Tender.		
1.6	No. of main coats considered for achieving required thickness		
1.7	Each coat thickness		
1.8	Primer required (Type)		
1.9	Primer coat thickness		
2.0	Blasting material to be used for carbon steel		
	<b>Main Coat Physical Properties</b>		
2.1	Impact Resistance		
2.2	Color		
2.3	Density		
	<b>Service Properties</b>		
2.4	Adhesion to Steel		
2.5	Abrasion Resistance		
2.6	Water vapor permeability/ Transmission rate		Not for zinc silicate primer.
2.7	Accelerated weathering		
2.8	Accelerated Salt Spray		
2.9	Chemical resistance immersion of 30 days in sea water -		
	% wt change		
	% hardness change		
	% tensile strength change		



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	% bond strength change		
3.0	Application		
3.1	Flash point at 30 degree cel.		
3.2	Mixing ratio		
3.3	Practical spreading rate		
3.4	Curing time		
	- for next coat		
	- for full cure		
3.5	Pot life at 30 oC		
3.6	Thinner if any		
3.7	Storage life / Self life		
3.8	Cleaning fluid		

\*Parameter which apply to the product, to be specified.



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**ANNEXURE -A**

**Table number- 01**

<b>Inorganic Zinc Silicate</b>			
<b>Sl. No.</b>	<b>Parameters</b>	<b>*Method</b>	<b>Acceptance criteria</b>
			<b>Primer</b>
1.0	<b>Coating Details</b>		
1.1	Type		Inorganic zinc silicate
1.2	Resin		EthylSilicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids %	ASTM D 2369	> 80%, by weight
	Total Zinc dust in dry film		> 84% by weight
1.8	Volume of Solids	ASTM – D-2697	> 65%
1.9	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
2.0	Pot life @ 30 deg.C		>4hour
2.1	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
2.2	Area Coverage (Theoretical)	IS 101, 1964	>8.5m <sup>2</sup> /l @ 75 micron thickness
2.3	Practical Coverage		Min. 6.25 micron thickness @ 75 micron thickness
2.4	Application		spray
2.5	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr  Hard dry < 18 hrs
2.6	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
2.7	Impact Resistance	ASTM D 2794	> 10 Joule
2.8	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.9	Thickness per coat	ASTM D 1186	70-80 μ
3.0	<b>Total thickness</b>		<b>70-80 μ</b>



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3.1	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
3.2	Accelerated Salt spray Test	IS 2074 or ASTM B117	The coated test panels dried for 48 hrs System should pass 3000hrs exposure without blistering and corrosion.
3.3(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
3.4(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%
3.5	Flexibility test panel bent 1 inch dia cylindrical mandrel	ASTM D-1979	System should pass free from detachment, crack, surface deformation, etc.



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Table number- 02

Zinc Rich Epoxy Primer

Sl. No.	Parameters	*Method	Acceptance criteria
			Primer
1.0	Coating Details		Zinc Rich Primer
1.1	Type		
1.2	Resin		Epoxy
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM Type II high purity grade
1.7	Zinc dust content in dry film	ASTM D 2369	> 80%
1.8	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
1.9	Pot life @ 30 deg.C		>3 hour
1.10	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
1.11	Volume of Solids	ASTM – D-2697	> 60%
1.12	Application		Airless spray
1.13	Impact Resistance	ASTM D 2794	> 10 J
1.14	Thickness per coat	ASTM D 1186	70-80 $\mu$
1.15	Total thickness		70-80 $\mu$
1.16	Accelerated Salt spray Test	ASTM B117	System should pass 1500 hrs exposure without blistering and corrosion.
1.17	Practical Adhesion by sandwich pull off technique.	ISO 4624	> 100 kg/sq cm.
1.18	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 200 mg



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Table number- 03

Aliphatic Polyurethane.

Sl. No.	Parameters	*Method	Acceptance criteria
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO <sub>2</sub>
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 ( Part 4/sec2 ) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 ( Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 ( Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 ( Part 5/ Sec 1) : 1988	52
2.5	Accelerated tests:		
	a).Resistance to sulphuric acid b).Resistance to caustic potash c).Resistance to solvent.	IS 13213:1991	Shall not show any signs of blistering, wrinkling and lifting. Difference in gloss and color between immersed and unimmersed area of paint film shall be minimum.
2.6	Durability Test		
	a). out doorexposure	IS 13213:1991	Chalking 10



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	b).Accelerated weathering test		Checking 10 Cracking 10 Flaking 10 Spotting 10 Blistering 10 Colour changes 7-8 Gloss :The film shall have a minimum gloss retention of 90 percent of its original value.
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**Table number- 04**

**Epoxy MIO**

Sl. No.	Parameters	*Method	Acceptance criteria
1.0	<b>Coating Details</b>		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m <sup>2</sup> /liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram )	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/ sec. 2 IS 101	Pass
2.3	Resistance to humidity under condition of condensation at 500 hr. a ). Resistance to humidity 500 hr.	IS 101 clause 2 of part 6 /sec.1	Pass
	b). Salt spray 500 hrs.	Clause 3 of part 6/sec 1.	Pass



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Table number- 05

Polyester Glass Flake

Sl. No.	Parameters	*Method	Acceptance criteria
1.	Shelf life		>6 months
2.	Pot life		>45 min at 30 deg C
3.	Volume solids	ASTM D 2697	>95 %
4.	Cathodic Disbondment	ASTM G8	Typically less than 1 mm disbondment following 30 days exposure
5.	Immersion	ISO 2812 Part 2 (Modified)- "Resistance to sea water immersion @ 40 Deg C.	No film defects following 8000 hours exposure.
6.	Salt Spray	ASTM B 117 Resistance to neutral salt spray (fog) @ 35 Deg C.	No film defects, and no rust creep at the scribe following 10000 hours exposure.
7.	Abrasion	ASTM D 4060-	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.
8.	Adhesion	ISO 4624 /ASTM D 4541	Not less than 90 Kg/cm <sup>2</sup> when using a PAT adhesion tester on 5mm thick steel.



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9.	Impact	ASTM D 2794	> 9 Joule.
10.	Tensile Strength	ASTM-D 2370	Not less than 200 Kg/cm <sup>2</sup>
11.	Elongation @ Break	ASTM-D 2370	> 0.5%
12.	Water vapour Permeability	ASTM- D 1653	< 0.2gm/m <sup>2</sup> -hr/mil



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Table Number-06

Heat Resistance Silicone based paint

Sl.no.	Parameter	*Method	Accept.Criteria
1.	Curing method		Ambient curing
2.	Volume solids	ASTM D 2697	>40 %
3.	Shelf life		> 1 year
4.	Flash point	ISO 3679	> 25 °c
5.	Temperature resistance	ASTM D 2485	> 350 °c
6.	Pot life @ 25°c		> 45 min.
7.	Drying time @ 25°c a). Touch dry b). hard dry		30 min. 2 hour
8.	Adhesion	ASTM D 4541	Not less than 70 Kg/cm <sup>2</sup> when using a PAT adhesion tester on 5mm thick steel.
9.	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM D 4060	< 250 mg
10.	Resistance to thermal shock		No sign of cracking and flaking after 3 cyclic exposure from 300 °C to 30 °C



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Table Number-07

High Build Epoxy			
Sl.no.	Parameter	*Method	Accept.Criteria
1.	Colour		As per color coding requirement
2.	Volume solids	ASTM D 2697	>80%
3.	Shelf life		> 1 year
4.	Pot life at 25 °c		> 1 hour
5.	Impact Resistance	ASTM D 2794	>6 Joule
6.	Adhesion	ASTM D 4541	> 10 Mpa
7.	Salt spray test	ASTM B 117	> 1000 hrs.
9.	Abrasion test	ASTM D 4060	< 200 mg [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]
10.	Tensile Strength	ASTM-D 2370	>100 Kg/cm <sup>2</sup>
11.	Elongation @ Break	ASTM-D 2370	> 6%
12.	Accelerated Weathering	ASTM D 4587	Should pass 500 hours a). Chalking b).Cracking and blistering.



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Table Number-08

Epoxy Phenolic tank liner

Sl.no.	Test	*Method	Accept.Criteria
1.	Color		As per requirement
2.	Volume solid	ASTM D 2697	>65%
3.	Pot Life @25°C		> 2 hour
4.	Shelf life		> 1 year
5.	Flash point	ISO 3679	> 25 °c
6.	Abrasion	ASTM D 4060-	< 200mg weight loss per 1000 cycles using CS17 wheels and a 1 Kg loading.
7.	Impact test	ASTM D 2794	> 7 Joule
8.	Adhesion	ISO 4624	>110 Kg/cm <sup>2</sup>
9.	Tensile Strength	ASTM-D 2370	> 100 Kg/cm <sup>2</sup>
10.	Elongation @ Break	ASTM-D 2370	> 6%
11.	Immersion test a). DM Water b). Petrol	ASTM D-1308	500 hrs System should pass free from defect like blistering, loss of adhesion
12.	Water vapour permeability	ASTM D 1653	< 4 gm/m <sup>2</sup> -hr/mil.



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Table number-09

Potable water storage tank

Sl. No.	Parameters	*Test Code	Specification for coating system
a). Eplilux 78- Burger HBTL			
b). Apcodur CF699- Asian Paints			
c). Or equivalent approval from CFTRI Mysore.			

Note-

- \*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.

## APPENDIX-B

### COATING SCHEDULE

Project Name :

Client

W.O. No.

Inspection Agency :

Site

Others

[illegible]



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**APPENDIX-C**

**COATING SYSTEM DAILY INSPECTION REPORT**

DATE	REPORT NO.	PROJECT REF. NO.	PAGE OF
PROJECT DESCRIPTION	LOCATION	CONTRACTOR	
INSPECTION ORGANISATION	INSPECTOR	APPLICABLE SPECIFICATION NO.	
<b>I. <u>DESCRIPTION OF ITEMS AND / OR AREAS</u></b>			
<b>II. <u>DESCRIPTION OF WORK PERFORMED / REMARKS</u></b>			



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II. <u>PRE-WORK SURFACE CONDITION</u>	OBSERVED DEFECTS	IV. <u>ENVIRONMENTAL CONDITIONS</u>
<ul style="list-style-type: none"><li>SUBSTRATE _____</li></ul>	OIL & GREASE **	TIME _____
<ul style="list-style-type: none"><li>GENERAL DESCRIPTION _____</li></ul>	SHARP EDGES **	---
<ul style="list-style-type: none"><li>PRIMED FOR SUBSEQUENT COATS.</li></ul>	WELD SPATTER **	AIR TEM/°C _____
<ul style="list-style-type: none"><li>REFERENCE REPORT DATED _____</li></ul>	MOISTURE **	---
<ul style="list-style-type: none"><li>PREVIOUSLY PAINTED – DEGREE OF CORROSION _____</li></ul>	LAMINATIONS **	WET BULB TEMP °C _____
<ul style="list-style-type: none"><li>NEW METAL – DEGREE OF CORROSION _____</li></ul>	SOLUBLE SALTS **	---
	_____ **	RELATIVE HUMIDITY °C _____
	_____ **	---
		DEW POINT °C _____
		---
		SURFACE TEMP MIN / MAX. °C _____
		_____
		_____
		REMARKS :
		_____
		_____
		_____



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ANNEXURE -D

DRY FILM THICKNESS MEASUREMENT WORKSHEET

DATE		REPORT NO.		PROJECT REF. NO.		APPLICABLE SPECIFICATION		PAGE OF	
ITEM / AREA DESCRIPTION		SPOT	SPOT READINGS (MICRON)			TOTAL	AVERAGE	% MIN	REMARKS
			1	2	3				
		A							
		B							
		C							
APPROX. SQ. MTR		D							
		E							

TOTAL  
AVG

SPECIFIED DFT-----MICRON

RANGE ACHIEVED -----MICRON

REFERENCE REPORT DATED ----- FOR APPLICATION RECORD

REMARKS

INSPECTOR'S SIGNATURE



DATE





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TECHNICAL SPECIFICATION  
FOR  
PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES

Number of the Document	I02	KK34	0	0	TH	TS	PR009
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Title	Total Number of Pages	Date	Revision Number
TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES	34	September , 2018	1

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NUCLEAR POWER CORPORATION OF INDIA LTD.  
(A Government of India Enterprise)

2 X 1000 MWe KUDANKULAM NUCLEAR POWER PROJECT  
UNITS - 1&2

DOCUMENT NO.: I02.KK34.0.0.TH.TS.PR009

TECHNICAL SPECIFICATION  
FOR  
PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES

REVISION NO.	:	R0	R1		
DATE OF ISSUE (MONTH / YEAR)	:	January ,2017	Sept, 2018		

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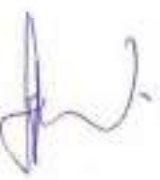

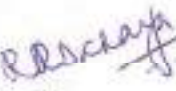
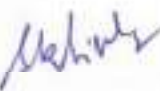



### REVISION CONTROL SHEET

DOCUMENT TYPE : TECHNICAL SPECIFICATION

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TITLE : TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES.

Revision No.	Description of Revision	Revised by Name & Signature	Checked by Name & Signature	Reviewed by Name & Signature	Approved by Name & Signature
01.	Parameter elated to zinc dust has been included in Table No-1 of Annex.A.  Scope of prequalification of paint has been excluded.  Section 8.1 has been modified.  Section 11 deleted.  Annexure-A Table 4 , 5, 6 has been added.	 P.C.Gaurav, EE(Engg.-LWR)	 V.H. Searia, Sr.EE (Engg.-LWR)   R.Gurnule, DCE (Engg.-LWR)	 R. R. Sahaya, (CE - CONTT, RP&S & CFD -Engg.-LWR)   S K Sinha CE (Engg.-LWR)	 Smt Rajee Guptan (AD-PSA-Engg-LWR)



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## **1.0 SCOPE**

This technical specifications is intended to cover, supply of coating materials, coating application , inspection, testing, repair and handling of paint related work of sea water system and sea water metal structure.

## **1.1 EXTENT OF WORK**

- a. All Carbon Steel Storage Tanks , pipes.
- b. All Carbon Steel, fittings, valves and flanges (including painting of identification marks ).
- c. Painting of color bands on all piping as required for identification including insulated aluminum clad, galvanized, SS, plastic or plastic coated and nonferrous piping/ equipment if any.(specification of identification and color coding to be given to the successful bidder at the time of execution of the work)
- d. Identification lettering/ numbering on all painted surfaces of equipment/piping insulated aluminum clad, galvanized, SS and non-ferrous piping.
- e. Repair work of damaged pre-erection/ fabrication and shop primer and weld joints in the field/site before and after erection as required.
- f. Supply, application, handling and storage of all primers, paints and all other materials required for painting.

## **1.2 EXCLUSION**

- a. Pre-qualification test of Paint System as specified at section 10.
- b. Plastic and/or Plastic coated materials – color of plastic shall be as per the color code. If not conforming , painting/ tapeing may be required for identification., Non-ferrous materials like aluminum, FRP/GRP piping and tanks color shall be as per the applicable color coding. If not conforming, painting/ tapeing may be required for identification.
- c. Painting of Stainless Steel and Duplex Stainless steel structure.



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## 2.0 REFERENCE CODES & STANDARDS

CODE /STANDRAD	TITLE
ISO 12944	Paint and varnish – corrosion protection of steel structure by protective paint system.
ISO 8501	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness
ISO 8502-3	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness - Assessment of dust on steel surfaces prepared for painting, pressure sensitive tape method.
ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast cleaned substrates.
ISO 8504-2	Preparation of steel substrates before application of paints and related products - Surface Preparation Methods - Abrasive blast-cleaning.
ISO 1513	Paints and varnishes - Examination and preparation samples for testing.
ISO 2808	Determination of film thickness
ISO 2409	Cross cut test.
SSPC-SP	Steel Structures Painting Council, U.S.A.
ASTM G 62-85	Standard Test Methods for Holiday Detection in Pipeline Coatings
ASTM D520	Standard Specification for Zinc Dust Pigment
ASTM D521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
IS 101	Methods of sampling and test for paints, varnishes and related products
ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D 5895	Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders



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ASTM D 1200	Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D 1186	Standard Test Measurement DFT.
ASTM D 4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM G-154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ISO 4624	Pull of test for adhesion



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### **3.0 EQUIPMENT**

- 3.1 All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning and all equipment's, scaffolding materials, shot & grit blasting equipment's & air compressors etc. required to be used shall be suitable for the work and all in good order and shall be arranged by the contractor at site and in sufficient quantity/nos. The manufacturer's test certificates / data sheets for all the above items shall be reviewed by Engineer-in-charge at site before start of work.
- 3.2 Mechanical mixer shall be used for paint mixing operations, except that the Engineer-In-Charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.

### **4.0 GENERAL REQUIREMENTS :**

- 4.1 The bidder shall provide comprehensive documentations detailing his previous experiences of using the specified coating systems. In particular this shall address internal lining of both large and small bore pipelines/ equipment's. This information shall be submitted with the bid.
- 4.2 The bidder may be required to set up a coating facilities at site complete with all necessary equipment, consumables and personnel to complete the work. The bidder is to confirm his intention to do this at the bid stage and submit details of the facility he proposes, including size of area required and utilities.
- 4.3 The bidder shall provide with his bid an inventory of the proposed equipment and personnel that will be used to execute the contract in the line with the project schedule.
- 4.4 The bidder shall provide a comprehensive execution plan and methodology of coating with the proposal.
- 4.5 The bidder shall perform all work in accordance with this specification and other requirements noted herein.
- 4.6 The bidder shall also supply along with his offer copies of test reports conducted by reputed test agencies evidencing that materials conform to minimum performance requirements attached anywhere in this specification.
- 4.7 The contractor will be totally responsible for field coating, field weld joint coating including testing and inspection of coated area.



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**5.0 COATING MATERIAL SPECIFICATION :**

5.1 The coating material should be as per properties indicated in Annexure- A & B.

**6.0 TECHNICAL REQUIREMENT OF PAINT APPLICATION**

**6.1 PRE-BLASTING :**

6.1.1 Scope of work include treatment of surface for application of protective coating, is as follow :

- a) Removal of oil/grease contamination
- b) Removal of salt deposit and other water soluble compounds
- c) Abrasive blasting
- d) Removal of dust and abrasive product

6.1.2 The surfaces shall be free from any foreign matter such as weld flux, residue, slivers, oil, grease, salt etc. prior to blast cleaning.

**6.2 BLAST CLEANING :**

6.2.1 Blasting abrasives shall be dry, clean and free from contaminants which will be detrimental to the performance of the coating.

6.2.2 In case of rain or bad weather, surface preparation shall not be carried out outdoors.

6.2.3 When surface is wet , surface preparation shall not be carried out.

6.2.4 Surface prep./Roughness profile of the cleaned surface shall conform to the paint manufacturer recommendations.

6.2.5 Substrate condition during blasting must be 3 degree Celsius above dew point temperature.

6.2.6 Irrespective of whether external or internal surface to be coated, blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceed 85%. Relative Humidity reading shall be recorded every 2 hour during the blasting operation in the immediate vicinity of



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operation.

- 6.2.7 If wet abrasive method is used for cleaning than the substrate shall be fully dried before application of any coating.
- 6.2.8 Compressed air used for blast cleaning shall be clean, dry and free of moisture and oil. Moisture separators, oil separator, traps or other equipment may be necessary to achieve clean, dry air.

**6.3 PAINT APPLICATION :**

- 6.3.1 Pre-fabrication primer is not a part of the paint system. It might need to removed.
- 6.3.2 The coating manufacturer shall provide a Data Sheet for each coating system to be used, containing at least the following information for each product:
- Surface pre-treatment requirements.
  - Wet film thickness/dry film thickness (max, min. and specified).
  - Maximum and minimum recoating intervals at 25 °C.
  - Information on thinners to be used (quantities and type).
  - Mixing, handling and application requirements/recommendations.
  - Pot life 30 °C.
  - Drying time at 25 °C
- 6.3.3 Paint/primer shall be applied after ensuring assessment of prepared surfaces as per ISO 8501-1 / ISO 8501-2
- 6.3.4 The elapsed time between the start of blasting and coating shall not exceed the maximum as given in the following table

Relative humidity	Maximum Time elapsed
Above 80%	2.0 Hour
Up to 80%	3.0 Hour
Up to 50 %	4.0 Hour



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- 6.3.5 At the end of pipe joint where welding is to take place a cut back (160 mm ) may be allowed in the coating depending upon the field joint coating method selected. The actual distance if any, shall be agreed prior to application.
- 6.3.6 Area not to be coated shall be masked with disposable plastic sheets, tapes, cardboards etc.
- 6.3.7 Prior to the application of each coat, a stripe coat shall be applied by brush to all welds, corners, behind angles, sharp edges of beams etc. and areas not fully reachable by spray in order to obtain the specified coverage and thickness.
- 6.3.8 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exists, when the Steel surface temperature is less than 3 degree C. above dew point, when the relative humidity is greater than 85% or when the temperature is below 5 degree. C
- 6.3.9 When the successive coat of the same color have been specified, alternate coat shall be tinted, where practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life and shall be recommended by the original paint manufacturer.
- 6.3.10 Field paint application shall not be done when the wind speed exceeds 20KM per hour.
- 6.3.11 All nameplates, manufacturer's identification tags, machined surfaces, instrument glass, finished flange faces, control valve items and similar items shall be masked to prohibit coating deposition. If these surfaces are coated, the component shall be cleaned and resorted to its original condition.
- 6.3.12 No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats.
- 6.3.13 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.
- 6.3.14 No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint.
- 6.3.15 Paint shall be protected from rain, condensation, contamination until dry to the fullest extent practicable.



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- 6.3.16 The method of application shall be governed by the coating manufacturer's Recommendation for the particular coating being applied.
- 6.3.17 Roller application of the first primer coat is not acceptable. When paints are applied by brush, the brush shall be of a style and quality acceptable to the coating manufacturer. Brush application shall be done so that a smooth coat, as uniform in thickness as possible is obtained.
- 6.3.18 Zinc silicate primer shall not be applied below relative humidity of 65%.
- 6.3.19 Spray application shall be in accordance with the following:
- Air spray application equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application.
  - All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted.
  - Areas inaccessible to the spray gun shall be painted by brush.
  - Airless Spray Application shall be done with an equipment having pump ratios at least 45:1 or as recommended by product manufacturer.

**6.4 FINAL SURFACE CONDITION :**

- 6.4.1 The maximum content of soluble impurities on the blasted surface as sampled using ISO 8502-6 and distilled water, shall not exceed a conductivity corresponding to a NaCl content of 20 mg/m<sup>2</sup>. Equivalent methods may be used.

**6.5 SURFACE PREPARATION AND PAINTING APPLICATION OF WELD/FLANGE JOINT :-**

- 6.5.1 Painting of flange is to be done as per Annexure-F
- 6.5.2 All equipment's & pipeline flange faces, internal coating shall be terminated within groove as per Annexure-F.
- 6.5.3 In case of pipeline flange, internal coating to be continued on the flange faces also. External coating shall be carried out at all metal surfaces including bolt hole excluding



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gasket area. Coating should never be terminated at edges/corners, it should be terminated at flat area.

**6.6 REPAIR OF DAMAGE SURFACE :**

- 6.6.1 Where paint has been damaged in handling and in transportation, the repair of damaged coating of pre-erection / fabrication and Shop primer shall be done by contractor.
- 6.6.2 The contractor shall prepare a field weld joint coating and a repair procedure for review and approval by Engineer-in-charge.
- 6.6.3 Defective work shall be rectified/repared by the contractor at his own expenses.



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## **7.0 INSPECTION AND TESTING**

### **7.1 COATING PROCEDURE QUALIFICATION :**


- 7.1.1 Prior to actual application on job, sample application shall be carried out to establish that the coating operation and coating material meet the requirements of this specifications.
- 7.1.2 Quality control tests shall be performed as follows :
- Blast cleanliness standard and profile inspection.
  - Salt contamination test
  - Visual testing.
  - Thickness testing, holiday inspection, adhesion testing, curing testing as per approved standard specified in this specification.
  - Repair procedure , as approved by NPCIL.
- 7.1.3 No application/production shall commence until the Contractor has performed all the above tests to complete satisfaction of Engineer-in -charge.

### **7.2 VISUAL INSPECTION**

- 7.2.1 Assessment of the prepared surfaces shall be visually assessed as described in ISO 8501.
- 7.2.2 Testing for soluble salt and other invisible contamination on visually cleaned surface by physical and chemical method shall assessed as per ISO 8502.
- 7.2.3 The surface roughness profile accordance with paint manufacturer shall be assessed as per ISO 8503.

### **7.3 THICKNESS TESTS**

- 7.3.1 The paint thickness shall be checked using non-destructive test.
- 7.3.2 Dry Film Thickness (DFT) Meter used shall be calibrated before each inspection and shall be witnessed by the Inspector. It is the duty of the Inspector to satisfy himself with the performance of the DFT Meter.
- 7.3.3 The Dry Film Thickness (DFT),as measured in accordance with ASTM D-1186, shall not vary by 10 % of the specified value.
- 7.3.4 The Area coverage of DFT measurement is as per SSPC-PA2.

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#### 7.4 HOLIDAY DETECTION

7.4.1 100% of the internally coated surfaces shall be tested.

7.4.2 Holiday testing shall be done in accordance with ASTM G-62 after curing of paints.

7.4.3 No holidays are accepted and all holidays shall be repaired. The average and the maximum repair rates allowable for holidays shall be :

Average	4 per day.
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If number is exceeded, or the daily average if exceeded for any 5 consecutive days of production , then application shall cease and the cause shall be investigate and resolved.

7.4 Adhesion test is destructive test and shall be done on applied surface selected by Engineer- in-charge if required, as per ISO 4624 or ASTM D4541.

#### 7.5 Environment condition test.

7.7.1 Following parameter to be checked

- a. Air Temperature (Max. & Min. )
- b. Relative humidity (Min. & Max.)
- c. Dew Point Temperature.
- d. Surface Temperature.
- e. Wind Speed (Max.)

7.7.2 In an interval of eight hour, data to be collected and recorded in data sheet. More frequent measurement to be done if conditions are changing rapidly and will be decided by Engineer-in-charge.

7.7.3 Sling Psychrometer to be used as per ASTM E337 to record wet & dry Temperature.



## 8.0 QUALIFICATION REQUIREMENTS

### 8.1 Qualification of products :

- 8.1.1 Pre-qualification of painting system shall be done by NPCIL. List of all such NPCIL approved paint products will be provided to EPC contractor.
- 8.1.3 Selection of Painting system shall be done by EPC contractor subjected to NPCIL approval.

### 8.2 Qualification of Personnel

#### 8.2.1 Qualification of paint applicator

Applicator shall be qualified to perform the task viz blast cleaning, application etc. The personnel shall have relevant knowledge of health and safety hazard, coating materials, use of protection equipment, etc.

If not qualified, personnel shall carry out a test in accordance with the standard Coating Procedure Specification. The test shall be supervised by a qualified supervisor and inspected and accepted by qualified QC personnel. A test certificate shall be issued.

The test shall be carried out on a test panel (minimum 1 x 1 m), 1 angle, 1 spool piece of pipe. Alternatively a location providing similar geometrical complexity on the component to be coated may be used.

The acceptance criteria are the requirements to the coating system described in this document. Variation in the film thickness shall be within the limits described in this specification. Applicator failing to meet the requirements shall not be allowed to carry out work in accordance with this document.



### **8.2.2 Qualification of procedures**

#### **Coating Procedure Specification (CPS)**

Supplier shall establish a detailed CPS based on the requirements of this document. The CPS shall contain the following:

- Identification of equipment for surface preparation and application.
- Information given on Coating System Data Sheet.
- Personal protective equipment to be used.
- Safety data sheets for each product.

The qualified CPS shall be followed during all coating work.

The following changes in the coating application parameters requires the CPS to be requalified:

- Any change of coating material.
- Change of method and equipment for surface preparation and coating application.

## **9.0 QUALITY ASSURANCE PLAN**

QAP shall be submitted by vendor according to this specification acceptance is subjected to NPCIL approval.



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**10.0 RECOMMENDED PROTECTIVE COATING SYSTEM.**

Sl.No.	Equipment's	System recommended	DFT/coat μm	No. of coats	Detailed specifications
1	Repair slide Gates, Embedded Guiding structure Embedded structuring cleaning machine (Rake)	Primer: Inorganic Zinc Silicate	70-80	1	Table No.- 1,2,3 of Annexure- A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	<b>230-260μ</b>		
2	Metal structure of Gate Storage  Embedded Structure of gate storage.	Primer: Inorganic Zinc Silicate.	70-80	1	Table No.- 1,2,3. of Annexure- A,B
		Under coat: Epoxy MIO intermediate coat.	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	<b>230-260μ</b>		
3	Column Beam and steel structure of screen cleaning machine.	Primer: Inorganic Zinc Silicate.	70-80	1	Table No.- 1,2,3 of Annexure- A,B
		Under coat: Epoxy MIO intermediate coat.	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	<b>230-260μ</b>		
4	External surface of CS Pipeline and support.	Primer: Inorganic Zinc Silicate	70-80	1	Table No.- 1,2,3 of Annexure- A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	<b>230-260μ</b>		
5	Internal surface of CS pipeline	Polyester Glass Flake	500-550	2	Table No.- 04 of Annexure- A,B
		<b>Total thickness (Min.)</b>	<b>1000-1100</b>		



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6	External surface of Buried (Soil) carbon steel pipeline.	Polyester Glass Flake	500-550	2	Table No.-04 of Annexure-A,B
		<b>Total thickness (Min.)</b>	1000-1100		
7	External Surface of accessible part of Condenser cooling water pipeline	Polyester Glass Flake	500-550	2	Table No.-04, 02 of Annexure-A,B
		Top coat : Aliphatic Polyurethane ( for color coding)	30	2	
		<b>Total thickness (Min.)</b>	1060-1170		
8	External surfaces of CS Tank. (except bottom portion)	Primer: Inorganic Zinc Silicate	70-80	1	Table No.-1,2,3 of Annexure-A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	230-260 $\mu$		
9	External surfaces of CS tank (soil side)	Coal Tar Epoxy	100	2	Table No.-05 of Annexure-A,B
		<b>Total thickness (Minimum)</b>	200 $\mu$		
10	Internal surfaces of CS tank ( Potable water )	Polyamine cured epoxy paint approval from CFTRI Mysore. <b>Total Thickness</b>	225-250 $\mu$		Table No.-06 of Annexure-A,B
11	Carbon steel Metal structure, platform, handrails, stairs, etc.	Primer: Inorganic Zinc Silicate	70-80	1	Table No.-1,2,3 of Annexure-A,B
		Under coat: Epoxy MIO	100-120	1	
		Top coat: Aliphatic Polyurethane	30	2	
		<b>Total DFT (Min.)</b>	230-260 $\mu$		



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**ANNEXURE –A  
(For Pre-Qualification)**

**Table number- 01**

<b>Inorganic Zinc Silicate</b>			
<b>Sl. No.</b>	<b>Parameters</b>	<b>*Method</b>	<b>Acceptance criteria</b>
			<b>Primer</b>
1.0	<b>Coating Details</b>		
1.1	Type		Inorganic zinc silicate
1.2	Resin		Ethyl Silicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids %	ASTM D 2369	> 80%, by weight
	Total Zinc dust in dry film		> 84% by weight
1.8	Volume of Solids	ASTM – D-2697	> 65%
1.9	Flash Point for primer and finish	IS 101 1964	> 15 degree C.
2.0	Pot life @ 30 deg.C		>4hour
2.1	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
2.2	Area Coverage (Theoretical)	IS 101, 1964	>8.5m <sup>2</sup> /l @ 75 micron thickness
2.3	Practical Coverage		Min. 6.25 micron thickness @ 75 micron thickness
2.4	Application		spray
2.5	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr  Hard dry < 18 hrs
2.6	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
2.7	Impact Resistance	ASTM D 2794	> 10 Joule
2.8	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.9	Thickness per coat	ASTM D 1186	70-80 μ
3.0	<b>Total thickness</b>		70-80 μ
3.1	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
3.2	Accelerated Salt spray Test	IS 2074 or ASTM B117	The coated test panels dried for 48 hrs System should pass 3000hrs exposure



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			without blistering and corrosion.
3.3(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
3.4(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%
3.5	Flexibility test panel bent 1 inch dia cylindrical mandrel	ASTM D-1979	System should pass free from detachment, crack, surface deformation, etc.



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**Table number- 02**

<b>Aliphatic Polyurethane.</b>			
<b>Sl. No.</b>	<b>Parameters</b>	<b>*Method</b>	<b>Acceptance criteria</b>
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO <sub>2</sub>
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 ( Part 4/sec2 ) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 ( Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 ( Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 ( Part 5/ Sec 1) : 1988	52
2.5	Accelerated tests:		
	a).Resistance to sulphuric acid b).Resistance to caustic potash c).Resistance to solvent.	IS 13213:1991	Shall not show any signs of listering, wrinkling & lifting. Difference in gloss and color between immersed and unimmersed area of paint film shall be minimum.
2.6	Durability Test		
	a). out door exposure b) Accelerated weathering test	IS 13213:1991	Chalking 10 Checking 10 Cracking 10 Flaking 10 Spotting 10 Blistering 10 Colour changes 7-8 Gloss :The film shall have a minimum gloss retention of 90 % of its original value.



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**Table number- 03**

<b>Epoxy MIO</b>			
<b>SL No.</b>	<b>Parameters</b>	<b>*Test Code</b>	<b>Requirement/Value</b>
1.0	<b>Coating Details</b>		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m <sup>2</sup> /liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram )	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/ sec. 2 IS 101	Pass
2.3	Resistance to humidity under condition of condensation at 500 hr. a ). Resistance to humidity 500 hr.	IS 101 clause 2 of part 6 /sec.1	Pass
	b). Salt spray 500 hrs.	Clause 3 of part 6/sec 1.	Pass



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Table number-04				
POLYESTER GLASS FLAKE				
Sl.No.	Test	Method	Test panels	Accept.Criteria
1.	Pot life			>45 min at 30 deg C
2.	Shelf life			>6 months
3.	Volume solids	ASTM D 2697		>95 %
4.	Cathodic Disbondment	ASTM G8 "Cathodic Disbonding of Pipeline Coatings" Method A	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Typically less than 0.1 mm disbondment following 30 days exposure
5.	Immersion	ISO 2812 Part 2 (Modified)- "Resistance to sea water immersion @ 40 Deg C.	1x500 micron DFT applied directly to SA 2.5 blasted steel.	No film defects following 8000 hours exposure.
6.	Salt Spray	ASTM B 117 Resistance to neutral salt spray (fog) @ 35 Deg C.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	No film defects, and no rust creep at the scribe following 10000 hours exposure.
7.	Abrasion	ASTM D 4060- "Abrasion Resistance of	1x500 micron DFT applied	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.



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		coatings via the Taber Abraser"	directly to SA 2.5 blasted steel.	
8.	Adhesion	ISO 4624-"Pull off test for adhesion" using portable adhesion testers.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Not less than 90 Kg/cm <sup>2</sup> when using a PAT adhesion tester on 5mm thick steel.
9.	Impact	IS 101 Part 5/sec3	1x500 micron DFT applied directly to SA 2.5 blasted steel.	Direct impact Resistane- Method A.
10.	Tensile Strength	ASTM-D 2370	1x500 micron DFT "free film"	200 Kg/cm <sup>2</sup>
11.	Elongation @ Break	ASTM-D 2370	1 x 500 micron DFT "free film"	> 0.5%
12.	Water vapour Permeability	ASTM- D 1653	1x500 micron dft "free film"	< 0.2gm/m <sup>2</sup> - hr/mil



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Table number-05

Coal Tar Epoxy

SL No.	Parameters	Test Code	Specification for coating system
Refer IS 14948:2001			



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**Table number-06**

**Potable water storage tank**

SL No.	Parameters	*Test Code	Specification for coating system
	a). Eplilux 78- Burger HBTL		
	b). Apcodur CF699- Asian Paints		
	c). Or equivalent approval from CFTRI Mysore.		

Note-

- \*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.



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**ANNEXURE- B  
(\*For Batch Testing)**

**Table number- 01**

<b>Inorganic Zinc Silicate</b>			
<b>Sl. No.</b>	<b>Parameters</b>	<b>*Test Code</b>	<b>Requirement/Value Primer</b>
1.0	<b>Coating Details</b>		
1.1	Type		Inorganic zinc silicate
1.2	Resin		Ethyl Silicate
1.3	Pigment		Metallic Zinc Dust
1.4	Zinc size	ASTM D520 ASTM D521	6-9 microns
1.5	Zinc shape		spherical
1.6	Zinc purity		> 98% Zinc dust conforming to ASTM type II purity grade.
1.7	Total solids %	ASTM D 2369	> 80%, by weight
	Total Zinc dust in dry film		> 84% by weight
1.8	Pot life @ 30 deg.C		>4hour
1.9	Shelf life @ 30 deg.C		Liquid >6 Months. Power > 12 months.
1.10	Volume of Solids	ASTM – D-2697	> 65%
1.11	Drying Time (minimum)	ASTM D 5895	Surface dry <3Hr  Hard dry > 18 hrs.
1.12	Cure test	ASTM D 4752	The coated test panels air dried for 48 hrs shall pass the cure test .
1.13	Impact Resistance	DEF 1050	Direct Impact of 10.5 lbs weight falling from 23 inch height,ball 12 mm diameter.system should pass free from cracking, detachment, at the peak or periphery of the buldge.
1.14	Viscosity (Kinematics) at 25 degree cel. in stokes.	ASTM D 1200	3 to 5
2.0	Abrasion Resistance [Material Loss for 1000 cycle at 1 kg load with CS17 wheel]	ASTM - D – 4060	< 250 mg
2.1(a)	Practical Adhesion by sandwich pull off technique.	ISO 4624	>90 kg/sq cm.
2.2(b)	Failure in cohesion by sandwich pull off technique	ISO 4624	>80%



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Table number- 02

Aliphatic Polyurethane.			
Sl. No.	Parameters	*Method	Acceptance criteria
1.1	Type		Aliphatic PU
1.2	Resin		Aliphatic Poly-Isocyanate
1.3	Pigment		R.TiO <sub>2</sub>
1.4	Flash Point for primer and finish	IS 101(part 1/sec 6) 1987	Not below 20 deg.C
1.5	Pot life @ 27 deg.C, min.	Annexure-E, IS 13213:1991	4 hour
1.6	Volume of Solids	Annexure-D, IS 13213:1991	40% (Min.)
1.8	Drying Time a). Surface dry, Max b). Hard dry, Max	IS 101 (Part 3/Sec 5) : 1987	3 Hr 8 Hr.
1.9	Dry Film Thickness	IS 13213:1991	35 Micron
2.0	Colour	As per IS 101 ( Part 4/sec2 ) : 1989	
2.1	Finish	IS 101 (Part 3/ sec.4):1987.	Smooth and Glossy
2.2	Flexibility and Adhesion Bend test 6.25 diameter mandrel type 1 apparatus.	IS 101 ( Part 5/ Sec 2) : 1988	No visible damage or detachment of film
2.3	Scratch hardness 1500 gram.	IS 101 ( Part 5/ Sec 1) : 1988	No such scratch as to show bare metal
2.4	Gloss at 45 degree angle of incidence, minimum	IS 101 ( Part 5/ Sec 1) : 1988	52



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**Table number- 03**

<b>Epoxy MIO</b>			
<b>Sl. No.</b>	<b>Parameters</b>	<b>*Test Code</b>	<b>Requirement/Value</b>
1.0	<b>Coating Details</b>		
1.1	Type		Epoxy MIO
1.2	Resin		Epoxy
1.3	Micaceous Iron oxide in percentage by mass	IS 101 clause 6 of IS 6947 (Part II)	50
1.3	Pigment		MIO
1.4	Area Coverage (Theoretical)		5.0 m <sup>2</sup> /liter @ 100 micron
1.5	Volume of Solids (Min.)		55%
1.6	Application		Spray/Brush
1.7	Drying Time (minimum)		Surface dry 3 hour. Hard dry 16 hour.
1.8	Color		brown
1.9	Thickness per coat		100-120
2.0	Total thickness		100-120
2.1	Scratch Hardness (1500 gram )	IS 101 Clause 3 of part 5/sec 2	Pass
2.2	Flexibility and adhesion	Clause 2 of part 5/sec. 2 IS 101	Pass



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Table Number-04

Polyester Glass Flake				
Sl.no.	Test	*Method	Test panels	Accept.Criteria
1.	Pot life			> 45 min at 30 deg C
2.	Shelf life			>6 months
3.	Volume solids	ASTM D 2697		>95 %
4.	Abrasion	ASTM D 4060- "Abrasion Resistance of coatings via the Taber Abraser"	1x500 micron DFT applied directly to SA 2.5 blasted steel.	< 224mg weight loss per 1000 cycles using H18 wheels and a 1 Kg loading.
5.	Adhesion	ISO 4624-"Pull off test for adhesion" using portable adhesion testers.	2x500 micron DFT applied directly to SA 2.5 blasted steel.	Not less than 90 Kg/cm <sup>2</sup> when using a PAT adhesion tester on 5mm thick steel.
6.	Tensile Strength	ASTM-D 2370	1x500 micron DFT "free film"	200 Kg/cm <sup>2</sup>
7.	Elongation @ Break	ASTM-D 2370	1 x 500 micron DFT "free film"	> 0.5%



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**Table number-05**

Coal Tar Epoxy			
Sl. No.	Parameters	Test Code	Specification for coating system
Refer IS 14948:2001			



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**Table number-06**

**Potable water storage tank**

Sl. No.	Parameters	*Test Code	Specification for coating system
a).	Eplilux 78- Burger HBTL		
b).	Apocodur CF699- Asian Paints		
c).	Or equivalent approval from CFTRI Mysore.		

Note-

- \*a). Equivalent standard other than specified in paint specification table can be accepted subjected to approval from NPCIL.




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### COATING SCHEDULE

Inspection Agency	:
Site	:
Others	:

[illegible]

	<b>NUCLEAR POWER CORPORATION OF INDIA LIMITED</b> <b>KUDANKULAM NUCLEAR POWER PROJECT - 3&amp;4</b>
<b>TECHNICAL SPECIFICATION FOR PAINTING OF SEA WATER SYSTEM EQUIPMENT, PIPING AND STRUCTURES</b>	<b>Page No. : 31</b> <b>Rev. No. : R01</b>

**APPENDIX-D**

**COATING SYSTEM DAILY INSPECTION REPORT**

DATE	REPORT NO.	PROJECT REF. NO.	PAGE OF
PROJECT DESCRIPTION	LOCATION	CONTRACTOR	
INSPECTION ORGANISATION	INSPECTOR	APPLICABLE SPECIFICATION NO.	
<b>I. <u>DESCRIPTION OF ITEMS AND / OR AREAS</u></b>			
<b>II. <u>DESCRIPTION OF WORK PERFORMED/ REMARKS</u></b>			

<b>III. <u>PRE-WORK SURFACE CONDITION</u></b> <ul style="list-style-type: none"> <li>SUBSTRATE _____</li> <li>GENERAL DESCRIPTION _____</li> <li>PRIMED FOR SUBSEQUENT COATS.</li> <li>REFERENCE REPORT DATED _____</li> <li>PREVIOUSLY PAINTED – DEGREE OF CORROSION -- _____</li> <li>NEW METAL – DEGREE OF CORROSION _____</li> </ul>	<b>OBSERVED DEFECTS</b> <table> <tr> <td>OIL, &amp; GREASE *</td> <td>*</td> </tr> <tr> <td>SHARP EDGES *</td> <td>*</td> </tr> <tr> <td>WELD SPATTER *</td> <td>*</td> </tr> <tr> <td>MOISTURE *</td> <td>*</td> </tr> <tr> <td>LAMINATIONS *</td> <td>*</td> </tr> <tr> <td>SOLUBLE SALTS *</td> <td>*</td> </tr> <tr> <td>_____ *</td> <td>*</td> </tr> <tr> <td>_____ *</td> <td>*</td> </tr> </table>	OIL, & GREASE *	*	SHARP EDGES *	*	WELD SPATTER *	*	MOISTURE *	*	LAMINATIONS *	*	SOLUBLE SALTS *	*	_____ *	*	_____ *	*	<b>IV. <u>ENVIRONMENTAL CONDITIONS</u></b> <p>TIME _____</p> <p>AIR TEM/°C _____</p> <p>WET BULB TEMP °C _____</p> <p>RELATIVE HUMIDITY °C _____</p> <p>DEW POINT °C _____</p> <p>SURFACE TEMP MIN / MAX. °C _____</p> <p>REMARKS : _____</p> <p>_____</p> <p>_____</p>
OIL, & GREASE *	*																	
SHARP EDGES *	*																	
WELD SPATTER *	*																	
MOISTURE *	*																	
LAMINATIONS *	*																	
SOLUBLE SALTS *	*																	
_____ *	*																	
_____ *	*																	



NUCLEAR POWER CORPORATION OF INDIA LIMITED  
KUDANKULAM NUCLEAR POWER PROJECT - 3&4

TECHNICAL SPECIFICATION FOR PAINTING OF SEA  
WATER SYSTEM EQUIPMENT, PIPING AND  
STRUCTURES

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ANNEXURE -E

DRY FILM THICKNESS MEASUREMENT WORKSHEET

DATE	REPORT NO.	PROJECT REF. NO.	APPLICABLE SPECIFICATION	PAGE OF				
ITEM / AREA DESCRIPTION	SPOT	SPOT READINGS (MICRON)			TOTAL	AVERAGE	% MIN	REMARKS
		1	2	3				
	A							
	B							
	C							
APPROX. SQ. MTR	D							
	E							

TOTAL  
AVG

SPECIFIED DFT----- MICRON  
RANGE ACHIEVED ----- MICRON

REFERENCE REPORT DATED ----- FOR APPLICATION RECORD

REMARKS

INSPECTOR'S SIGNATURE

DATE



NUCLEAR POWER CORPORATION OF INDIA LIMITED  
KUDANKULAM NUCLEAR POWER PROJECT - 3&4

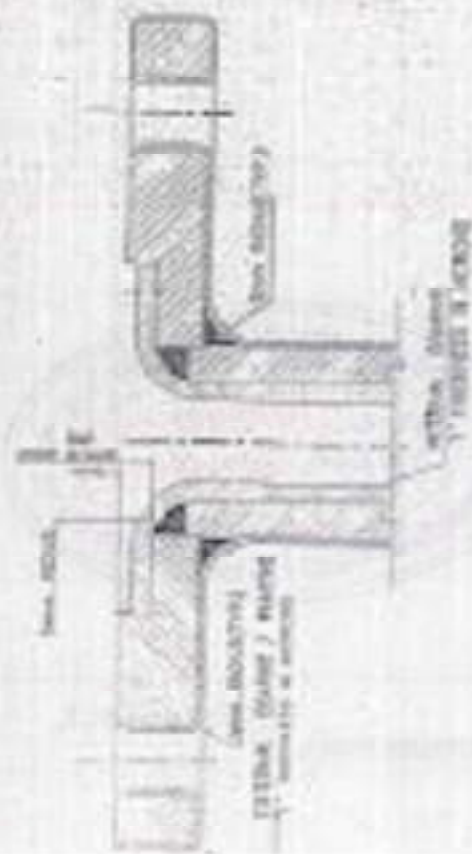
TECHNICAL SPECIFICATION FOR PAINTING OF SEA  
WATER SYSTEM EQUIPMENT, PIPING AND  
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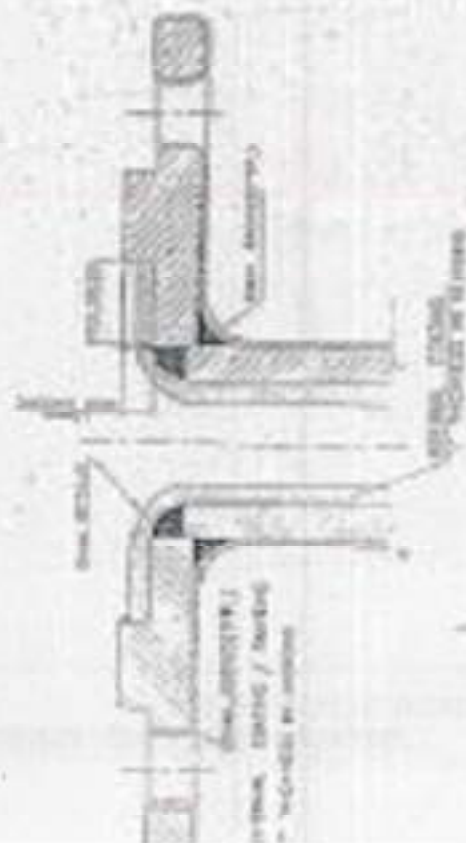
**ANNEXURE- F**  
**PAINTING ON FLANGE JOINT**



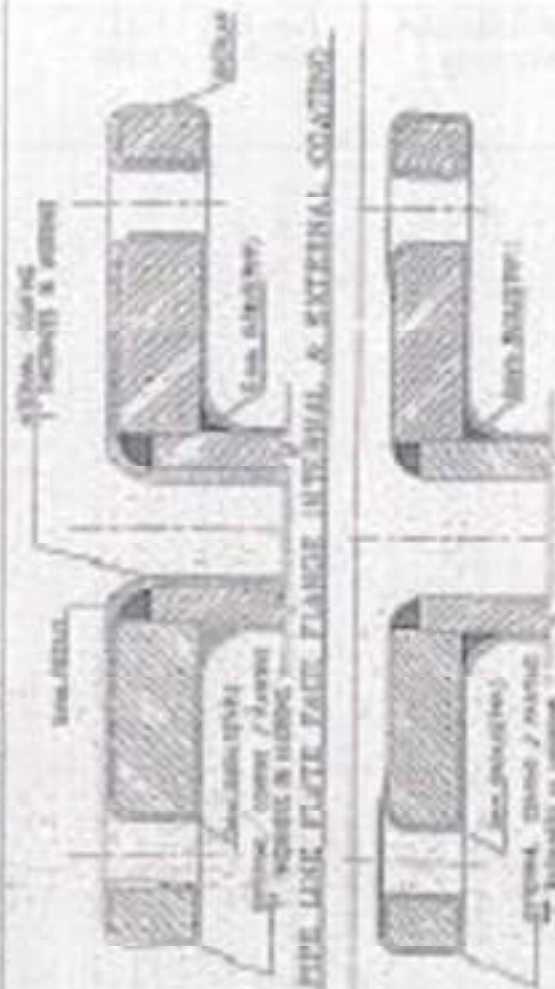
# COATING METHODS ON FLANGE SURFACE



EQUIPMENT FLAT FACE FLANGE COATING



EQUIPMENT RAISED FACE FLANGE COATING



PIPE LINE FLAT FACE FLANGE EXTERNAL COATING



PIPE LINE RAISED FACE FLANGE INTERNAL / EXTERNAL COATING



PIPE LINE RAISED FACE FLANGE EXTERNAL COATING

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## VOLUME-IA PART – I CHAPTER – III

### FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL

#### (SCOPE MATRIX)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
<b>1.3.1</b>	<b>PART I</b>			
<b>1.3.1.1</b>	<b>ESTABLISHMENT</b>			
<b>1.3.1.1.1</b>	<b>FOR CONSTRUCTION PURPOSE:</b>			
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	
<b>1.3.1.1.2</b>	<b>FOR LIVING PURPOSES OF THE BIDDER</b>			
1.3.1.1.2.1	Open space for Labour colony	Yes		As provided by NPCIL
1.3.1.1.2.2	Living accommodation		Yes	
<b>1.3.1.2</b>	<b>ELECTRICITY</b>			<b>Chargeable Basis</b>
<b>1.3.1.2.1</b>	<b>Electricity For construction Purposes</b>			Prevailing rate of TANGEDCO
1.3.1.2.1.1	Single Point source	Yes		(Each one point at unit 3 & 4)

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	
1.3.1.2.3	Distribution from single point including supply of materials and service		Yes	
1.3.1.2.4	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.5	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.6	Demobilization of the facilities after completion of works		Yes	
<b>1.3.1.3</b>	<b>WATER SUPPLY</b>			
1.3.1.3.1	For construction purposes		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc		Yes	
<b>1.3.1.4</b>	<b>LIGHTING</b>			
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	
<b>1.3.1.5</b>	<b>COMMUNICATION FACILITIES for site operations of the bidder</b>			
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	
<b>1.3.1.6</b>	<b>COMPRESSED AIR SUPPLY</b>			
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	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
<b>1.3.2</b>	<b>PART II</b>			
<b>1.3.2.1</b>	<b>ERECTION FACILITIES</b>			
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	Valve testing facility	Yes		Shifting, handling of valves and operation in bidders scope
1.3.2.1.7	Grit blasting & Painting shed (only empty shed)	Yes		Equipments for grit blasting & Painting in Bidder 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	
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	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### **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 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 – one point at each unit of required capacity from BHEL Panel board located in Turbine building of unit-3 & 4 and one point for Contractor office & storage area from nearest BHEL Panel board by BHEL on chargeable basis at the applicable rate of TANGEDCO under LT tariff. The present LT tariff 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
- The TANGEDCO tariff and tax may vary from time to time and same shall be charged to the contractor. 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 make their own arrangement for further distribution to the site of work using armored Power cable and MCB distribution boards.
- 1.3.4.2 Contractor to maintain log sheet with BHEL engineering in charge signature for weekly/ monthly power consumption and healthiness of ELCB.
- 1.3.4.3 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 1.3.4.4 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.
- 1.3.4.5 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.
- 1.3.4.6 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.
- 1.3.4.7 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.
- 1.3.4.8 Sea water Piping system work in tunnel area of unit-3 and unit-4 covers more than 1.2 KM appx from TG building. Power supply cannot be extended from the given power point in Unit -3 & 4 TG building due to distance restriction. Hence required capacity of DG set along with panel shall be arranged by the contractor at his quoted rates for execution of work.
- 1.3.4.9 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 1987 (as amended/latest)
  - iv. TNEB regulations (latest)
- 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.
- 1.3.4.10 **DOMESTIC POWER SUPPLY FOR LABOUR CAMP**
- i. 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### **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 out side. Bore well is not permitted in side 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**

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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, by **NPCIL** 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 NPCIL 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. 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### **In addition, the following Clause is applicable:**

- 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 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.
- 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 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM**

- i. Minimum 2 computers (along with one operator per PC) for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate.
- ii. Computers shall have latest configuration of Windows 10 OS, 8 GB RAM.

### **1.3.10 SECURITY OF CAMP:**

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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 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.

### 1.3.11 WATER FOR LABOUR CAMP

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.

### 1.3.12 CONSUMABLES:

- i. For executing the work on free issue material from NPCIL, welding electrodes and filler wire will be issued as free issue material by NPCIL and only supply of welding consumables like gases will be in the scope of contractor.
- ii. For executing the work on all BHEL supplied material like Pipes, fittings, Valves, strainers and structural steel work, the supply of welding electrodes, filler wires, and welding consumables are in the scope of contractor.
- iii. Contractor to obtain prior approval of BHEL/NPCIL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL/NPCIL. The contractor shall inform BHEL/NPCIL details regarding type of electrodes, batch number and date of expiry etc.
- iv. All gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as wrap cloth, tapes, jointing compound, grease, lubricants, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Scaffolding materials and pre-assembly materials, hardware items etc required for temporary works such as supports, scaffoldings, bed are to be arranged by the contractor. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work shall be arranged by the contractor.
- v. Supply of all required consumables in adequate quantity such as birkosit, molybdenum-disulphide, zinc oxide, Ortho phosphoric acid, molykote 1000, hylomar, stag B, loctite, neverseez, white grease, araldite, rustoline, acetone, kerosene, shell ensys 30 oil, insulation spray, varnish, contact cleaner, double boiled linseed oil, white lead, red lead, graphite, diesel, iso-propanol, interplus 634, paint disbonder, lint free cloth etc, supply of

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Ammonia for hydro testing of pipelines The list is only indicative and the contractor shall supply all the items deemed necessary for the completion of the work.

- vi. For all the temporary structures, contractor shall supply all the materials including welding electrodes and consumables.
- vii. In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.

### **1.3.13 MATERIAL SUPPLY BY NPCIL (Free issue material):**

- i. Materials required for the work covered under this tender such as pipelines, tubes, pipe fittings, valves, supports, and other connected components of systems including welding electrode and filler wire will be supplied as free issue as specified in respective items by NPCIL. 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.
- ii. 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.

### **1.3.14 MATERIAL SUPPLY BY CONTRACTOR**

- i. Supply and preparation of blanks for hydro test & flushing.
- ii. Supply of fasteners as required.
- iii. Supply of primer & paint as per technical specification.
- iv. Supply of grouting & concreting material as per technical specification.

Note: Contractor to obtain prior approval of BHEL/NPCIL for all supplies in his scope.

### **1.3.15 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)

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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. Any recovery by NPCIL towards non compliance of above and dual benefit to contractor of any govt announced scheme will be passed to the contractor .

### 1.3.16 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
- ii. from time to time for the respective category of workmen to be paid. The contractor
- iii. shall pay to his workmen any increase in the minimum wages as notified from time to time during the period of contract.
- iv. The contractor has to provide free transport facility to his workmen.
- v. 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.
- vi. 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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prescribed forms 3A, 6A and 12A to the EPF authority with copy to the Engineer.

- vii. 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 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.

### **1.3.17 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.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## VOLUME-IA PART-I CHAPTER – IV

### T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR

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

Indicative List of Plant And Machinery To Be Deployed		
S.no	Description of Equipment	Qty ( nos.)
	<u>Welding</u>	
1	Welding machine	20
2	High frequency TIG welding machine	10
3	Pipe chamfering machine	As required
4	Pipe bending machine	As required
5	Grinding Machine	15
6	HDPE welding machine	4
7	Mother oven	2
8	Portable oven	15
9	Transfer oven	4
10	De humidifier	As required
11	Plasma cutting machine	As required
12	Gas cutting set	5
13	Fitter tool kit	20
14	Engraving machine	As required
	<u>NDT</u>	
15	RT source with camera	2
16	X-ray machine	1
17	UT machine	2
18	RT film Digitization equipment	As required
	<u>Facilities</u>	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Indicative List of Plant And Machinery To Be Deployed		
S.no	Description of Equipment	Qty ( nos.)
19	DG set	As required
20	Elcometer, Surface comparator	As required
21	Holiday/Adhesion/Hardness tester	As required
22	Painting facilities with suitable machines for grit blasting	As required
23	Anticorrosive coating facilities with suitable machines	As required
	<b><u>MHE and load carrier</u></b>	
24	Mobile crane Tyre Mounted 60T or above	1
25	Hydra 16-20T	2
26	Electric winch 10T	As required
27	Trailer 40 Feet	1
28	Tipper	As required
29	Tractor trailer	As required
30	Poclain with back hoe	As required
31	Dozer	As required
32	Tata Ace HT/ Tata 407	1
	<b><u>Rigging</u></b>	
33	Hydraulic jacks	As required
34	Chain pulley block/Ratchet lever hoist (Upto 20 T)	As required
35	Wire rope slings	As required
36	Web slings	As required
37	D- shackle	As required
38	Bow shackle	As required
39	Eye bolt	As required
40	Manila rope	As required
41	Skid roller	As required
	<b><u>Machines</u></b>	
42	Hand Drilling machine	As required
43	Insitu boss drilling machine	2

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Indicative List of Plant And Machinery To Be Deployed		
S.no	Description of Equipment	Qty ( nos.)
44	Air Compressor 400 cfm	2
45	Torque wrench	As required
46	Hydraulic torque wrench	As required
47	Drilling machine	As required
48	Power hacksaw	1
	<b><u>Testing and Measurements</u></b>	
49	Total station	As required
50	Dumpy level	As required
51	Pressure gauges	As required
52	Electric hydro test pump	As required
53	Theodolite	As required
54	Vernier calipers	As required
55	Boroscope for FME Inspection	As required
56	Weld gauges	As required
57	Profile gauge	As required
58	Hardness gauge	1
	<b><u>Concreting</u></b>	
59	Jack hammer	As required
60	Hilti hammer/core drilling machines	As required
61	Concrete Core cutting machine	As required
62	Transit mixer, Vibrator	As required
	<b><u>Grit blasting &amp; Painting</u></b>	
63	Compressor	As required
64	Blasting Hopper	As required
65	Spray Pump	As required
66	Electrical Stirrer	As required
67	Coating Pot	As required
68	Whirling Hygrometer	1

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Indicative List of Plant And Machinery To Be Deployed		
S.no	Description of Equipment	Qty ( nos.)
69	Infrared Thermometer	1
70	Dial Thickness Gauge	1
71	Salt Soluble Tester	1
72	DFT Gauge	1
73	Holiday Tester	1
74	Adhesion Tester	1
75	Multiple Gas Detector	1
	<b><u>Miscellaneous</u></b>	
76	Vacuum cleaner	As required
77	Pump Required for filling and flushing	As required
78	Hot Air blower	As required
79	24V transformer	As required
80	Dewatering pumps	As required
81	Tapset, Dieset and Reamers	As required
82	Scaffolding set	As required
83	Plotter and printers	As required
84	Water tanker	As required
85	Lux Meter	1
86	Sound Meter	1
87	Exhaust fan	As required
88	Fire extinguishers	As required
89	PPEs	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 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 shall give advance intimation and certification regarding capacity etc.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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prior to dispatch of heavy equipments. 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 All the tools & plants , Measuring Monitoring Equipment (MME) , special tools which are required for this scope of work are to be arranged by the contractor within the quoted rates.
- 1.4.4 Fill pumps of sufficient capacity shall be arranged by the contractor, wherever required, within quoted rates.
- 1.4.5 For testing pipelines necessary Hydraulic Test pumps/ Hand pumps are to be arranged by the contractor with in the quoted rates
- 1.4.6 Depending upon the nature of work and availability of facilities locally, contractor may have to arrange for a temporary workshop for facilitating uninterrupted progress of work.
- 1.4.7 For transportation, material handling, loading & unloading of all components / equipments, the contractor has to make his own arrangements at his own cost. All necessary T&P such as, Trailers, Cranes Winches, welding generators, Slings, Jacks, Sleepers, Rails etc. are to be arranged by the contractor.
- 1.4.8 All the T & P, cranes, 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.
- 1.4.9 The age of all contractor deployed cranes shall 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.
- 1.4.10 Crane operators deployed by the contractor shall be tested by BHEL/NPCIL before he is allowed to operate the cranes. The crane load test has to be conducted before deployment as per statutory guidelines.
- 1.4.11 The crane operators deployed must be capable of independently operating Hydraulic/Mechanical Crawler / Tyre mounted Cranes of respective categories. The crane operators must have relevant experience in Operation of Hydraulic/Mechanical Crawler / Tyre Mounted Cranes in respective categories & hold valid HMTV / TRANS license. Should be able to read and interpret the operation and maintenance manual, boom load chart, boom angle and other indicating devices. Operator shall have latest Physician's certification for their physical fitness in vision with/without Lenses & adequate hearing with or without hearing aid. The

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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operator hired by the contractor may be tested by BHEL/NPCIL Engineer for the suitability of the crane operation during any point of time while executing the contract.

1.4.12 In the event of non-mobilization of Cranes, Tools, Plants, Machinery, Equipment or non-availability of the same owing to breakdown and as a result progress of work suffered, BHEL reserves the right to make alternative arrangement at the risk and cost of the contractor. Actual expenses incurred by BHEL along with applicable overheads will be back charged to the contractor.

1.4.13 In the event of non-mobilization of Tools, Plants, Machinery, Equipment, Material or non-availability of the same owing to breakdown and as a result progress of work suffered, BHEL reserves the right to make alternative arrangement (available or higher capacity) in line with SCC clause no. 4.2.1. 7 and hire charges shall be applicable as under:

**Case 1: BHEL provides its own Capital T&P:** If BHEL provides owned T&P then BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges applicable (as enclosed in Volume I Book I TCC- Volume 1A Part II) as per following cases

- In case the T&P is specifically listed in “T&Ps to be deployed by Contractor”, ‘Rates of hire charges applicable to outside agencies other than contractors working for BHEL’ will apply.
- In case the T&P is not specifically listed in “T&Ps to be deployed by Contractor”, ‘Rates of hire charges applicable to contractors working for BHEL’ will apply. The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g., Operator, fuel & Consumables and the same shall be arranged by the contractor at his cost.

**Case 2: BHEL provides hired T&P:** In all cases other than that specified in SI No. 1 above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor. The present rates of BHEL’s Corporate Crane hire charge, are enclosed in Chapter 2 of part II of Technical Conditions of Contract (Volume-I Book-I). This may get revised further as per the BHEL corporate guidelines. The prevailing rates as on date of execution shall be applicable.

## VOLUME-IA PART-I CHAPTER – V

### ERECTION & TESTING FACILITIES TO BE PROVIDED BY BHEL

- 1.5.1 List of Erection & Testing facilities to be made available by BHEL to contractor at free of cost on sharable basis for execution of works within the scope of this tender are as below.
- i. 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.
  - ii. Grit blasting & painting shed. Only empty shed will be provided by BHEL. Any partition required for Grit blasting & painting shed shall be carried out by the contractor at his cost. Grit blasting & painting equipment's are in the scope of contractor.
- 1.5.2 All the erection facilities mentioned in clause 1.6.1 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, testing facilities. Measuring instruments which are required for satisfactory completion of the work has to be arranged by the contractor.
- 1.5.4 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
- 1.5.5 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.
- 1.5.6 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.
- 1.5.7 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 1.5.8 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.
- 1.5.9 Any loss / damage to any or part of the above equipment's 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.

## VOLUME-IA PART-I CHAPTER – VI

### TIME SCHEDULE

#### 1.6.1 TIME SCHEDULE

1.6.1.1 The entire work of Erection, alignment, welding, NDT, flushing, hydro testing, fabrication of structural steel, pipe supports, metal structures & platforms, supply & application of primer & finish paints as per requirement of Sea water piping system and all associated Piping in tunnel, buildings & buried portion including excavation, sand filling and construction of Inspection chamber including handling at site stores / storage yard, transporting to site at KKNPP UNIT 3 & 4 shall be completed **within 36 (Thirty Six) months from the date of commencement of work at site.**

1.6.1.2 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.

1.6.1.3 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.

#### 1.6.2 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.

#### 1.6.3 MOBILISATION FOR ERECTION AND TESTING

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

### 1.6.4 TENTATIVE MILESTONE SCHEDULE FOR UNIT 3 & 4

Sl. No.	Milestone Description	Milestone Month (Tentative)	
		Unit 3	Unit 4
1	Start of work	1 <sup>st</sup> Month	
2	Erection completion of HDPE Piping	20 <sup>th</sup> Month	22 <sup>nd</sup> Month
3	Completion of Buried Piping	24 <sup>th</sup> Month	26 <sup>th</sup> Month
4	Erection completion of PEB Piping in UQZ Tunnel	32 <sup>nd</sup> Month	34 <sup>th</sup> Month
5	Completion of Contractual Obligations	36 <sup>th</sup> Month	

1.6.4.1 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.

1.6.4.2 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.

### 1.6.4.3 MAJOR INTERMEDIATE MILESTONES

Sl. No.	Intermediate Milestone Description	Intermediate Milestone	Intermediate Milestone Month (Tentative)	
			Unit 3	Unit 4
1	Completion of Buried Piping	M1	24 <sup>th</sup> Month	26 <sup>th</sup> Month
2	Erection completion of PEB Piping in UQZ Tunnel	M2	32 <sup>nd</sup> Month	34 <sup>th</sup> Month

### PENALTY FOR INTERMEDIATE MILESTONES

- M1 and M2 shall be intermediate milestone for each Unit of this work. Totally 4 intermediate milestones shall be applicable for the package, which consists of 2 Units.
- 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.
- In case delay in achieving each M1 milestone is solely attributable to the contractor, 0.5% per week of executable contract value\* limited to maximum 1% of executable contract value will be withheld.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- iv. In case delay in achieving each M2 milestone is solely attributable to the contractor, 0.5% per week of executable contract value\* limited to maximum 1.5% of executable contract value will be withheld.
- v. 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 corresponding M2 milestone.
- vi. 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.
- vii. 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.
- viii. 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.

### **1.6.5 CONTRACT PERIOD**

The contract period for completion of entire work under scope shall be 36 months from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

### **1.6.6 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

### TERMS OF PAYMENT

1.7.1 Advance for Mobilization is not applicable for this tender.

1.7.2 TERMS OF PAYMENT

BOQ item no	The following percentage of quoted rates of BOQ items will be paid on submission of respective reports along with RA bill after completion of relevant activities of the work on pro-rata basis.				
	Stage	1	2	3	4
	Work	70%	20%	5%	5%
F1.1, F1.3, F1.5, F2, F4, F5, F6.1,F6.2,F6.3	Welding (CS/SS/Ti)	Welding Inspection Report		CCC	Material Accounting Statement.
F7.2	Preparation of weld edge	Welding Report	Welding Inspection Report	CCC	Material Accounting Statement.
F8	Erection of (CS/SS/Ti)	Erection Report	Hydro test Report	CCC	Material Accounting Statement.
F10	Passivation of SS piping	Passivation Report	Erection Report (25%)		CCC
F12.1,F12.2,F12.3	Assembly of flanged joints	Flange Alignment Report	Hydro test Report	CCC	Material Accounting Statement.
F13	Valves (VTF)	Valve Testing Report		CCC	Material Accounting Statement.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

BOQ item no	The following percentage of quoted rates of BOQ items will be paid on submission of respective reports along with RA bill after completion of relevant activities of the work on pro-rata basis.				
	Stage	1	2	3	4
	Work	70%	20%	5%	5%
<b>F14</b>	Valves ( Erection)	Erection Report	Welding Inspection Report / Flange Alignment Report	CCC	Material Accounting Statement.
<b>F15.3.1, F15.3.2, F15.3.3</b>	Supports	Erection Report	Hydrotest Report	CCC	Material Accounting Statement.
<b>F18</b>	Stub/O-let drilling	Drilling Report	FME Inspection Report	CCC	Material Accounting Statement.
<b>F19, F20, F21, F22</b>	NDT (CS/SS/Ti)	NDT Report	Hydro test Report	CCC	Material Accounting Statement.
<b>F23</b>	Testing (CS/SS/Ti)	Hydro test Report	Draining & De-watering Report	CCC	Material Accounting Statement.
<b>F31</b>	Digitalization of RT films	Soft copy of films		CCC	Material Accounting Statement.
<b>F32</b>	Erection of GRP/FRP piping	Erection Report	Hydro test Report	CCC	Material Accounting Statement.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

BOQ item no	The following percentage of quoted rates of BOQ items will be paid on submission of respective reports along with RA bill after completion of relevant activities of the work on pro-rata basis.					
	Stage	1	2	3	4	5
	Work	40%	30%	20%	5%	5%
<b>G1.1, G1.2, G1.3, G2.1, G2.2, G2.4, G3.1, G3.2, G4.1, G4.2, G5.1</b>	Erection of PEB, PUQ, PGB, GKD, GML system for both units of KKNPP-3&4.	Erection Report against proportionate release of payment for the completed work.	Welding inspection Report against proportionate release of payment for the completed work.	NDT and Hydro test Report against proportionate release of payment for the completed work.	CCC	Material Accounting Statement.
<b>G1.4, G2.3</b>	Erection of Pipe supports of PEB, PUQ, PGB, GKD, GML system & HDPE pipe	Erection Report against proportionate release of payment for the completed work.	Welding inspection Report against proportionate release of payment for the completed work.		CCC	Material Accounting Statement.
<b>G7</b>	Erection of HDPE pipe and pipe fittings & supports, indoor and outdoor including RCC hume pipe.	Erection Report against proportionate release of payment for the completed work.	Welding inspection Report against proportionate release of payment for the completed work.	Hydro test Report against proportionate release of payment for the completed work.	CCC	Material Accounting Statement.
<b>G8.1, G8.2, G9, G10, G11.1, G11.2, G11.3</b>	Excavation and back filling for buried piping works, Inspection chamber construction	Completion Report (95%)				CCC

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

BOQ item no	The following percentage of quoted rates of BOQ items will be paid on submission of respective reports along with RA bill after completion of relevant activities of the work on pro-rata basis.				
	Stage	1	2	3	4
	Work	70%	20%	5%	5%
H2.1	Fabrication of Metal structures	Weight Analysis Report and Fabrication Report		CCC	Material Accounting Statement.
H2.2	Erection of metal structures	Weight Analysis Report and Erection Report		CCC	Material Accounting Statement.
H5.1 to H5.6	Fixing of Hilti anchor fasteners by normal drilling	Fixing Report		CCC	Material Accounting Statement.
H6	Core drilling	Core drilling Report	Fixing Report	CCC	Material Accounting Statement.
I1	Grit blasting and supply and application of primer.	Grit blasting, Painting & inspection Report (95%)			CCC
I2.1, I2.2	Supply & Application of paint	Painting & inspection Report (95%)			CCC
K1.1,K1.2,K1.3,K1.4,K1.5,K1.6, K1.7, K1.8,K1.9, K1.10	Supply and Application of anti-corrosive paint Polyester Glass Flake on field joints	Painting & testing Reports (95%)			CCC
K2,K3	Supply and Application of intermediate/ finish coat	Painting & testing Reports (95%)			CCC
L2	Chipping of concrete	Chipping Completion Report (95%)			CCC

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

BOQ item no	The following percentage of quoted rates of BOQ items will be paid on submission of respective reports along with RA bill after completion of relevant activities of the work on pro-rata basis.				
	Stage	1	2	3	4
	Work	70%	20%	5%	5%
L7.1, L7.2	Core cutting of RCC slab/wall	Core Cutting Completion Report (95%)			CCC
L8.1.1, L8.1.2, L8.1.3	Man power assistance during repair works	Muster card (100%)			
L8.2.1, L8.2.2, L8.2.3	Man power assistance during re-preservation	Muster card (100%)			
L8.4.1, L8.4.2, L8.4.3	Man power assistance during System pre-handing over checks.	Muster card (100%)			

Note:

- (i) Refer Part II Chapter 1 of this Technical Conditions of Contract for Corrections/ Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures.

## 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           - BHEL Site Office  
                    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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

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.

## VOLUME-IA PART-I CHAPTER –IX

### BILL OF QUANTITY

Please refer to Volume II, Price Bid, Part-C for detailed BOQ.

#### 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) 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
- C) Bidders shall refer Volume II, Price Bid, Part –A for Instructions.
- D) Bidders shall quote 'Total Amount' in the format enclosed as a separate Excel File in BHEL NIC e-Procurement portal for the subject tender and upload the same under 'Packet details - > Tender covers -> Finance '(Cover Type Description – Price Bid)'' and same shall be taken into account for evaluation and awarding and hence, shall be complete in all respect for the full scope of work defined in specification and in accordance with terms & conditions of the tender. 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..
- E) The above mentioned 'Total amount' is for the entire Bill of Quantity (BOQ) given in Part -C of the Price Bid.
- F) 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.
- G) 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.
- H) Based on the quantities of individual item and the amount arrived in Sl.No.: G) above, unit rate of individual items shall be derived. This unit rate shall be rounded off to four decimal places.
- I) 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. H) above.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## VOLUME-IA PART-I CHAPTER –X

### GENERAL

- 1.10.1 The successful bidder shall furnish the following at PSSR-HQ, Chennai immediately after release of Letter of Intent (LOI)
- i. Security Deposit.
  - ii. Unqualified Acceptance for LOI.
  - iii. Unqualified Acceptance for Detailed LOI.
  - iv. Rs.100/- Stamp Paper for preparation of Contract Agreement.
- 1.10.2 The successful bidder shall 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 (Volume1C of Book-II) the contractor shall comply with the following:
- 1.10.3.1 BOCW Act & BOCW Welfare Cess Act
- 1.10.3.1.1 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.
- 1.10.3.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL
- 1.10.3.1.3 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.,
- 1.10.3.1.4 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.

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- 1.10.3.1.5 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, fees paid towards registration of beneficiaries and contribution of beneficiaries remitted.
- 1.10.3.1.6 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.
- 1.10.3.2 PROVIDENT FUND
- 1.10.3.2.1 The contractor is required to extend the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of this letter of intent. In case you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to you.
- 1.10.3.2.2 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.
- 1.10.3.3 OTHER STATUTORY REQUIREMENTS
- 1.10.3.3.1 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 and Valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.
- 1.10.3.3.2 The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

1.10.3.3.3 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.

1.10.3.3.4 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.

1.10.3.3.5 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.

1.10.3.3.6 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.

### 1.10.3.4 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 tradesmen along with requisite certificate from recognized

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

### 1.10.3.5 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.

- a) Victim: Any person who suffers permanent disablement or dies in an accident as defined below.
- b) 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.
- c) 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)

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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### 1.10.4 GENERAL

1.10.4.1 Site Visit by the Bidder The prior to submitting his tender for the work, visit, examine and acquire full knowledge & information and necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory 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.

1.10.4.2 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.

1.10.4.3 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.

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- 1.10.4.4 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.
- 1.10.4.5 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 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.
- 1.10.4.6 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.
- 1.10.4.7 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.
- 1.10.4.8 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.
- 1.10.4.9 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.
- 1.10.4.10 The contractor shall carryout additional tests, if any, which the Engineer feels necessary because of site conditions and also to meet system specification.
- 1.10.4.11 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, coordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 1.10.4.12 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.
- 1.10.4.13 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence. 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 any reasons whatsoever.
- 1.10.4.14 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.
- 1.10.4.15 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.
- 1.10.4.16 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.
- 1.10.4.17 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.
- 1.10.4.18 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.
- 1.10.4.19 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.
- 1.10.4.20 The contractor must obtain the signature and permission of the security personnel of the customer / BHEL for bringing any of their materials inside

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

- 1.10.4.21 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.
- 1.10.4.22 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.
- 1.10.4.23 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.
- 1.10.4.24 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.
- 1.10.4.25 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on latest ISO 9001 Standards.
- 1.10.4.26 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.
- 1.10.4.27 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.
- 1.10.4.28 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.4.29 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.

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- 1.10.4.30 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.
- 1.10.4.31 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.
- 1.10.4.32 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.
- 1.10.4.33 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess draws at the rate prescribed by manufacturing units.
- 1.10.4.34 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Boiler, piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope.
- 1.10.4.35 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand
- 1.10.4.36 SITE INSPECTION
- 1.10.4.36.1 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.
- 1.10.4.36.2 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.

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- 1.10.4.36.3 The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.
- 1.10.4.36.4 Field Quality Assurance (FQA) Formats:- It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and Owner as token of their acceptance. Payment to the contractor will be inked with the submission of these FQA log sheets.
- 1.10.4.36.5 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.
- 1.10.4.36.6 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
- 1.10.4.37 DOCUMENTATION
- 1.10.4.37.1 The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval
- a) Bar chart covering planned activities at site.
  - b) Detailed organization chart.
  - c) Details of T&P available with contractors with documents proofs.
- 1.10.4.37.2 The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by BHEL representative also.
- 1.10.4.38 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.

## VOLUME-IA PART-I CHAPTER –XI

### PROGRESS OF WORK

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

- 1.11.1 Refer forms F -14, F-15 as per relevant chapters of Vol-1A Part-II of TCC. Also refer Form F-16 to F-18 in Volume I D of Volume -I Book-II. Plan and review will be done as per the above formats. These should be submitted on monthly basis with duly signed by BHEL and Contractor.
- 1.11.2 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.
- 1.11.3 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.
- 1.11.4 Tenderers have to furnish a list of Tools and Plants including cranes, Tractor / Trailers etc., which they propose to deploy for this work.
- 1.11.5 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.
- 1.11.6 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.7 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.
- 1.11.8 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.11.9 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details:-

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- b) Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
- c) Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.
- d) 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.
- e) Consumables report giving consumption of all types of gases and electrodes during the previous month.
- f) Availability report of cranes.
- g) Safety implementation report in the format.
- h) Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

## VOLUME-IA PART-I CHAPTER –XII

### MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

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.)

- 1.12.1 Loading of material 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 of contractor. 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.
- 1.12.2 The storage yard is located in more than one location within the Main Plant Boundary.
- 1.12.3 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.
- 1.12.4 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.
- 1.12.5 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.
- 1.12.6 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.
- 1.12.7 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.

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- 1.12.8 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.
- 1.12.9 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting of the components at site.
- 1.12.10 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.

## VOLUME- I A      PART-I      CHAPTER – XIII

### 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.)

- 1.13.1 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.
- 1.13.2 **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.
- 1.13.3 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.
- 1.13.4 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.
- 1.13.5 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

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- shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.
- 1.13.6 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 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.
- 1.13.7 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.
- 1.13.8 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.
- 1.13.9 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.
- 1.13.10 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.
- 1.13.11 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.
- 1.13.12 Supply, machining of required permanent packer plates, shims are in the scope of contractor.
- 1.13.13 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.

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- 1.13.14 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 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.
- 1.13.15 Grouting/concreting 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.
- 1.13.16 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.
- 1.13.17 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.
- 1.13.18 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.
- 1.13.19 PROCEDURE FOR GROUTING:
- 1.13.20 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.

## VOLUME- I A PART-I CHAPTER – XIV

### SAFETY

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)).

#### 1.14.0 SAFETY CLAUSE/CONDITIONS:

##### 1.14.1 PROJECT SAFETY PLAN

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.

##### 1.14.2 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

In addition to the requirement of safety officer and supervisors as mentioned, contractor shall deploy safety sevaks in sufficient nos. to suitably provide safety coverage of entire area of work in line with the quantum of field works and nos. of locations. The safety sevaks shall be technical persons with diploma or ITI qualifications and shall be provided with back pack consisting of PPE's and shall continuously monitor the safety aspects at site and shall report any safety lapses immediately.

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Safety work permits shall be applied by contractor through IPMIS (computerized software tool).

### **1.14.3 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.

Note: All the Safety personnel shall be accepted after the assessment by NPCIL.

### **1.14.4 TRAINING REQUIREMENTS**

1.14.4.1 The Contractor shall provide mandatory Industrial Safety Training to all workmen.

1.14.4.2 The Contractors shall establish their own safety training centre having adequate seating capacity and infrastructure for training.

1.14.4.3 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.

1.14.4.4 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.

1.14.4.5 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.

1.14.4.6 The safety supervisors and the safety engineers will have to undergo refresher safety training in safety supervision and accident prevention

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techniques conducted by National safety Council or other recognized institutions once in a year.

### **1.14.5 REQUIREMENTS AND SPECIFICATION OF PPES**

- 1.14.5.1 Contractor shall submit a list of PPEs that shall be used during the course of the work, to BHEL before the commencement of work.
- 1.14.5.2 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.
- 1.14.5.3 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.

### **1.14.6 PERSONAL PROTECTIVE EQUIPMENT**

#### **1.14.6.1 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 recognised 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.

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### 1.14.6.2 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.
- 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 2.5 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

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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.

### **1.14.7 WORK PRACTICES**

#### **1.14.7.1 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.

#### **1.14.7.2 WORK AT HEIGHT**

- a) For carrying out work at height of more than 2.5 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 2.5 meters from stable floor or ground floor. All implements used for height work such as scaffold, access stairs/ladders, platform, 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.

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### 1.14.7.3 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, 1987 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.
- 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.

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- g) At least one portable fire extinguisher (DCP or CO<sub>2</sub>) 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

### 1.14.7.4 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 signalman, 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.

### 1.14.7.5 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.

### **1.14.8 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.

### **1.14.9 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.

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- 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.

### **1.14.10 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.

### **1.14.11 WORK SPECIFIC SAFETY MEASURES**

#### **1.14.11.1 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 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.

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- 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.

### 1.14.11.2

#### **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 unauthorised 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. Licence 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, 1987 (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.

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### 1.14.11.3 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.
- 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

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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 undercutting 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 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.

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

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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 unauthorised person rides the transport equipment employed in such work.

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.

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.

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.
- (iii) A scraper moving downhill is driven in low gear.

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

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(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.

Vehicle carrying excavated material should have proper cover over the driver's cabin.

### 1.14.11.4 **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 2.5 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 2.5 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) Only metal platforms are allowed for any working platform. The platform should be rigidly fixed at both ends to prevent sliding, slipping or tilting.
- 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.

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Scaffolding and ladder should conform to IS 3696 (Part 1): 1987 and (Part II): 1996.

- 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 2.5 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.

### 1.14.11.5 **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.

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- f) In case where 'work at height' is on asbestos roof, crawling board, roof ladder should be used to walk across the asbestos roof.

### 1.14.11.6 **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 1987 (as amended in 2000)
  - 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).

### 1.14.11.7 **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.

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- 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 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

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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.

### 1.14.11.8 **WELDING AND GAS CUTTING**

- 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.

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- 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.

### 1.14.11.9 **ROTARY CUTTERS/GRINDERS**

- a) All portable cutter/grinders should be provided with the wheel guard in position.
- b) Grinding wheels of specified diameter only should be used on all grinders in order to limit the prescribed peripheral speed.

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- 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.

### 1.14.11.10 **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

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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.
- i) Workers engaged for handling bulk cement in a confined place should be provided with tight fitting goggles, approved respirators and protective clothing, which will fit snugly around the neck, wrist and ankles.

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.

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.

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.

### 1.14.11.11 **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

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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-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.

### 1.14.11.12 **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.

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- 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 authorised persons wearing safety helmets and safety shoes.

### 1.14.11.13 **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.
- 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.

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### 1.14.11.14 **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.

### 1.14.11.15 **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

### 1.14.11.16 **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.

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- 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.

### 1.14.11.17 **ENVIRONMENTAL SAFETY**

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

### 1.14.12 **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.

### 1.14.13 **SAFETY OF VISITORS**

- 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.

### 1.14.14 **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.

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- 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) It should be recognised that a proper place for everything and everything in its place is maintained for a good housekeeping.
- g) The material required for immediate use only should be brought to the designated workplace and stacked properly and labelled suitably.
- h) 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.
- i) 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.
- j) 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.
- k) 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.
- l) Accumulation of water/oil spillages on the floor or any other workplace should be avoided.
- m) Proper aisle space marking should be provided in all workplaces.

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## **1.14.15 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 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.

## **1.14.16 PENALTY STRUCTURE FOR NON-COMPLIANCE OF SAFETY REQUIREMENTS**

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.

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. Violation of such statutory and regulatory requirements shall attract a penalty mentioned in Annexure-1 under respective categories.

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.

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.

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

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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.

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## ANNEXURE -1

### 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>
2.0	<u>Safety Training</u> <ul style="list-style-type: none"><li>➤ Worker found without safety induction training or refresher training</li><li>➤ Worker found without safety training card</li></ul>	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	<ul style="list-style-type: none"><li>➤ Not providing required PPEs to the workmen</li><li>➤ Not using PPEs or using PPEs in incorrect manner or using defective PPEs.</li></ul>	Rs 2000 per violation Rs 500 per violation

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5.0	<u>Work at Height</u> <ul style="list-style-type: none"> <li>➤ Workers working at height without height pass.</li> <li>➤ Working at height without Height work permit</li> <li>➤ Working at height without safe means of access</li> <li>➤ Width of platform less than 1m Not providing adequate handrails, mid rails &amp; toe guards</li> <li>➤ Not providing adequate anchorage point for safety harness</li> </ul>	Rs. 10,000 per violation
	<ul style="list-style-type: none"> <li>➤ Unsafe working platform</li> <li>➤ Not providing safety nets, fall arrestors, life line etc. where required</li> <li>➤ Using uncertified scaffolds/working platforms</li> <li>➤ Not providing inspection tags on scaffolds/working platforms</li> </ul>	Rs. 10,000 per violation
6.0	<u>Electrical Safety</u> <ul style="list-style-type: none"> <li>➤ Use of unsafe/damaged /nonstandard electrical equipment/ appliances</li> <li>➤ Drawing power supply from power socket without plug</li> <li>➤ Drawing power without or bypassing</li> <li>➤ ELCB</li> <li>➤ Faulty/inadequate earthing</li> <li>➤ Unsafe cable joints</li> <li>➤ Use of non-standard power distribution boards, extension boards</li> <li>➤ Not carrying out periodic inspection of electrical system/equipment (without inspection stickers on PDBs, extension boards, power tools etc.)</li> <li>➤ Not providing fire extinguisher &amp; rubber mat near PDBs.</li> <li>➤ Using polycarbonate switches, plugs and sockets instead of metal clad sockets and plugs</li> <li>➤ Non-deployment of electrician</li> </ul>	Rs 20,000 per violation

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

7.0	<u>Material Handling</u> <ul style="list-style-type: none"> <li>➤ Use of machinery, tools and tackles not having valid inspection certificate</li> <li>➤ Use of faulty/damaged material handling equipment</li> <li>➤ Operation of MH machine/equipment by unauthorized personnel</li> <li>➤ Not deploying trained signalmen</li> <li>➤ Not displaying safe working load, date of inspection and next due date on material handling equipment</li> </ul>	Rs 15,000 per violation
8.0	<u>Welding, Gas cutting and other hot works</u> <ul style="list-style-type: none"> <li>➤ Using faulty/unsafe welding, gas cutting, hot work equipment</li> <li>➤ Using earthed structure as welding return circuit</li> <li>➤ Un-insulated joints in welding cable Not using flashback arrestor in gas cutting set</li> <li>➤ Not ensuring colour coding or valve cap on cylinders</li> <li>➤ Unsafe handling of gas cylinders Not following fire prevention measures</li> </ul>	Rs 5000 per violation
9.0	<u>Safe storage of material</u> <ul style="list-style-type: none"> <li>➤ Unsafe stacking of structural steel material, reinforcement rods etc.</li> <li>➤ Unsafe storage of gas cylinders, non-chaining of cylinders</li> <li>➤ Unsafe storage of flammable/ corrosive liquids</li> </ul>	Rs 1000 per violation
10.0	<u>Fire protection and Fire fighting arrangements</u> <ul style="list-style-type: none"> <li>➤ Not providing fire protection and fire fighting arrangements</li> <li>➤ Not providing adequate numbers of fire extinguishers</li> <li>➤ Not removing unwanted combustibles from worksites</li> </ul>	Rs 5000 per violation

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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11.0	<u>Transportation of man and material</u> <ul style="list-style-type: none"><li>➤ Using material transport vehicle for transporting people</li><li>➤ Overloading of vehicle</li><li>➤ Two-wheeler drivers not using protective helmet</li><li>➤ Vehicles used without valid certificates</li><li>➤ Unsafe transportation of material Vehicles with faulty reversing horns, head lamps, horns, brakes etc.</li></ul>	Rs 1000 per violation
12.0	<u>Housekeeping</u> <ul style="list-style-type: none"><li>➤ Non compliance of Housekeeping requirements.</li><li>➤ Urinating/defecating in non designated places</li><li>➤ Spitting in workplaces.</li><li>➤ Smoking in workplaces</li><li>➤ Writing graffiti in workplaces</li><li>➤ Temporary sheds in unauthorized places</li></ul>	Rs 1500 per violation

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## 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 \_\_\_\_\_

#### 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)

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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: \_\_\_\_\_

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## 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.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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 arrestor/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.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

### **NPCIL SECURITY RULES & MEDICAL MANAGEMENT**

#### **1.15.1      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.

##### **1.15.1.1      ENTRY/ EXIT OF MANPOWER**

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

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).

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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.**

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.**

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.

### 1.15.1.2 ENTRY/ EXIT OF MATERIALS

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.

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.

Loading of materials belonging to contractors inside plant premises, on to trucks/ tractor-trailers/ any other vehicles for taking out of plant premises shall

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

### **1.15.1.3 Entry/ Exit of Vehicles**

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.

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.

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

### **1.15.1.4 Mobile Passes**

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.

### **1.15.1.5 Photography in Project Premises**

Photography in Project Premises is strictly Prohibited.

### **1.15.2 EMERGENCY PREPAREDNESS DRILL**

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.

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.

### **1.15.3 LABOUR EMPLOYMENT**

EMPLOYMENT OF UNSKILLED PERSONS FROM AMONG THE DISPOSSESSED FAMILIES

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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.

### 1.15.4 **CORPORATE SOCIAL RESPONSIBILITY**

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.

### 1.15.5 **MEDICAL MANAGEMENT**

#### **FIRST AID CENTRE & AMBULANCE FACILITY**

One First aid centre 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 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.

### **1.10.5.1 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.

## VOLUME- I A      PART-I      CHAPTER – XVI

### HOUSE KEEPING

#### **1.16.1      MAINTENANCE OF CLEAN SITE CONDITIONS AND HOUSEKEEPING**

##### **1.16.1.1      CONSTRUCTION MATERIALS AND DEBRIS**

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.

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.

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.

##### **1.16.1.2      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.

##### **1.16.1.3      OTHER REQUIREMENTS**

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.

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. 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.

##### **1.16.1.4      TOILET FACILITY AT WORK SITE**

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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.

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.

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

**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

### 1.16.1.5 **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.

### 1.16.2 **HOUSEKEEPING ORGANIZATION OF THE CONTRACTOR**

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	
2	100 to 500	01	02	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

### 1.16.3 **QUALIFICATION OF HOUSEKEEPING SUPERVISOR SHALL BE AS FOLLOWS:**

- Housekeeping In charge:  
Any Degree / Diploma in engineering with two years project/ Industrial experience
- Housekeeping Supervisor:  
+2 with one-year Project/ Industrial experience or Any diploma

### 1.16.4 **TRAINING REQUIREMENTS**

- Along with the induction safety training, the workmen should undergo housekeeping training along with safety training.
- Housekeeping workers shall undergo training in usage of housekeeping equipments and tools such as vacuum cleaners.
- 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.

### 1.16.5 **REQUIREMENTS AND SPECIFICATION OF TOOLS**

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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
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

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.

### **1.16.6 HOUSE KEEPING WORK PRACTICES:**

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.

### **1.16.7 HOUSEKEEPING OF OWN WORKS:**

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- a) 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.
- b) 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.
- 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. In case Contractor fails to comply with the instruction of Engineer-In-Charge, he may get the work done at the risk and cost of the Contractor.
- d) The Contractor shall on day to day basis remove from the work place all unwanted scaffoldings, surplus materials, rubbish, etc.
- 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) Contractor shall keep supervisor and supporting staff exclusively for housekeeping of own works.
- g) Contractor shall submit the minimum manpower deployment schedule on monthly basis based on the approved housekeeping plan/ schedule for the approval of the ENC.

### **1.16.8 HOUSEKEEPING OF THE ASSIGNED AREA / BUILDING:**

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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### 1.16.9 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

### 1.16.10 SCOPE FOR EXECUTION OF HOUSEKEEPING WORK:

- 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.
- 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 the plant premises on regular intervals.
- Cutting of bushes and up keeping of open storage areas
- 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 the plant premises on regular intervals.
- Disposal of debris from dust bins/baskets placed in the respective building within the plant premises on once in a week basis or as and when required.
- 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- g) 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.
- h) The exclusive work force shall be deputed for the 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.
- i) 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.

### **1.16.11 PROVIDING WORK FORCE / STAFF:**

The Contractor shall deploy adequate manpower as per clause 1.15.2 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 authorised representative.

### **1.16.12 REPORTING:**

- a) The Housekeeping Supervisor(s) should report daily to the AIC (Area in charge) & take day-to-day instructions.
- b) The Contractor shall make sure that Housekeeping Supervisor(s) is necessarily available during working hours for receiving & implementing the Instructions of the AIC.
- c) It shall be the responsibility of the Contractor to get the attendance of the housekeeping staff verified by AIC.
- d) 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.
- e) However, certain jobs will necessarily be carried out during Sundays, for which instructions should be taken by the Housekeeping Supervisor(s) from AIC.
- f) Proper registers/records of the jobs carried out on daily, weekly, fortnightly and monthly basis will be maintained by the Housekeeping Supervisor(s) and
- g) 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- h) 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.
- i) The Contractor shall be equipped to handle the special/emergency services even at short notice.
- j) All equipment deployed shall be of quality standard.
- k) 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.

### **1.16.13 SANITATION / TOILET FACILITY AT WORK SITE**

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.

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.

### **1.16.14 DISPOSAL OF WASTE AND DEBRIS**

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.

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.

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.

All soil, filth or other matter of an offensive nature taken out of any trench, sewer, drain, 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.

## 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**

#### **EARNEST MONEY DEPOSIT**

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

**1.9 EARNEST MONEY DEPOSIT**

**Void. (Explanation: EARNEST MONEY DEPOSIT is not applicable for this tender.)**

**Bid Security Declaration:** Bidders to submit the Bid Security Declaration as per format provided in Volume IA Part II Chapter 9 of Technical Conditions of Contract.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## **SI No: 5**

### **SECURITY DEPOSIT**

**The following clause under clause 1.10 Security Deposit in General Conditions of Contract (Volume I Book II) are revised as below:**

- 1.10.1 Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit towards fulfilment of any obligations in terms of the provisions of the contract. **The total amount of Security Deposit will be 3% of the contract value. However, it is to be noted that any subsequent communication in this regard by GOI / BHEL needs to be complied.**
- 1.10.3 The balance amount to make up the required **Security Deposit of 3%** of the contract value may be accepted in the following forms.

**The following clause is added under clause 1.10 Security Deposit in General Conditions of Contract (Volume I Book II):**

- 1.10.8 Bidder agrees to submit security deposit required for execution of the contract within the time period mentioned. In case of delay in submission of security deposit, enhanced security deposit which would include interest (Base rate of SBI + 6%) for the delayed period, shall be submitted by the bidder. Further, if security deposit is not submitted till such time the first bill becomes due, the amount of security deposit due shall be recovered as per terms defined in NIT / contract, from the bills along with due interest

**All other terms & conditions of clause No. 1.10 of GCC remain unchanged.**

## **SI No: 6**

### **PRICE VARIATION COMPENSATION (PVC)**

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

- 2.17. 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 during contract period and for works executed during extended period, if any, subject to other conditions as described in this section.**
- 2.17.5 Base date shall be calendar month of actual commencement of work at site.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

**All other terms & conditions of clause No. 2.17 of GCC remain unchanged.**

**SI. No.: 7**

Existing format on Monthly Plan Review with 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.: 8**

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 03) is enclosed.

**SI. No.: 9**

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

**SI. No.: 10**

The chapter Reverse auction procedure published in 'Forms and Procedures' of Volume I Book-II stands deleted. 'Guidelines for Reverse Auction-2021' available in the website <http://www.bhel.com> -> Supplier Registration, shall be applicable.

**SI No: 11**

Procedure 2.3 that forms the part of Forms and Procedures is published as Chapter 11 in Volume IA Part II of this booklet (Volume-I Book-I).

**SI No.: 12**

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

**VOLUME-IA PART – II**

**CHAPTER 2-11**

In the next 198 pages as below:

Chapter	Details	No. of sheets
Chapter 2	NPCIL Checklist For Evaluation Of Subcontractors	05
Chapter 3	Tentative Weight Schedule	27
Chapter 4	Drawings	45
Chapter 5	Health, Safety and Environment Plan for Site Operation By Subcontractors	82
Chapter 6	Format for Form no.: F-14 (Rev 01); Monthly Plan And Review with Contractors	06
Chapter 7	Format for Form no.: F-15 (Rev 03); Monthly Performance Evaluation of contractor	08
Chapter 8	Hire charges on issue of capital tools & Plants (Only corresponding charges)	10
Chapter 9	Format for Bid Security Declaration (in lieu of Earnest Money Deposit)	01
Chapter 10	Proforma of Bank Guarantee (in lieu of Security Deposit)- Form WAM 22	03
Chapter 11	Procedure 2.3 of Arbitration & Conciliation	11

**Annexure-1**

Checklist No. QA.PC.WD011/1-R-1

**CHECKLIST FOR EVALUATION OF SUBCONTRACTORS***[To be filled and submitted by the contractor]*

Contractor:	BHEL	W.O.Number	400442
Package:	TSS Package		
Item:	Sea Water Piping Package Unit 3 & 4	BOQ/WD No	Schedule F, G, H, I, K, L

**PART 1: SUBCONTRACTOR DETAILS**

Registered Company Name:			
Registered Address:			
Phone:		E-Mail:	
Fax:		Website:	
Details of 'scope of work to be subcontracted':			
Sea Water Piping Package Unit 3 & 4			
Number of years in business:			
Employee Strength:			
(Please attach the Organization Chart of the Company)			
Key persons to be contacted:			
Top management:			
Quality Assurance:			
Marketing:			
Does the Subcontractor have several plants/branches?		Yes/No	
If Yes, please provide details:			

[illegible]

**PART 3: QUALITY MANAGEMENT SYSTEM**

Part 3	Quality Management System	Yes	No	Comments
3.0	Do you have valid ISO: 9001 certification?			Enclose copy
3.1	Do you have a Quality Manual?			
3.2	Do you have an internal and external audit programme in place?			
3.3	Do you have a staff training programme in place?			
3.4	Purchasing Process: <ul style="list-style-type: none"><li>Do you have a controlled list of approved suppliers?</li><li>Are your suppliers assessed and monitored?</li><li>Are order quality requirements clearly defined?</li></ul>			
3.5	Inspection Process: <ul style="list-style-type: none"><li>Are there documented procedures for the inspection and testing of items?</li><li>Are there documented procedures for inward, in-process and final inspection?</li><li>Are incoming items and raw material inspected upon receipt?</li><li>Is acceptance/rejection criteria defined?</li><li>Are rejected items identified and segregated?</li><li>Are process cards used for monitoring product inspection and test activities at each stage?</li><li>Are QA stamps/stickers used and controlled?</li></ul>			
3.6	Are QA records pertaining to item maintained?			
3.7	Are monitoring and measuring devices controlled, calibrated and records available?			
3.8	Records of NDE qualification of QC personnel available?			
3.9	Do you have full/partial identification and traceability of item? Please specify: [full traceability required for QA1,QA2 and QA3 category items]			

3.10	Product Handling Process:			
	<ul style="list-style-type: none"> <li>Do you have a procedure on handling and storage of items?</li> </ul>			
	<ul style="list-style-type: none"> <li>Are shelf life items controlled and monitored?</li> </ul>			
3.11	Do you have a procedure for controlling customer property?			
3.12	Do you have a procedure to confirm customer documents are of latest revision before being issued for use?			
3.13	Do you have a procedure for controlling deviations to customer specification?			
3.14	Control of records (process cards, test results, etc.). How long do you retain quality records?			
3.15	Is non-conforming item clearly identified?			
3.16	Is there a documented NC control procedure?			
3.17	Do you have a documented customer complaint procedure?			
3.18	Are there documented procedures for corrective actions?			
3.19	Would you permit access to NPCIL personnel for QS/audit of your Quality Management System and processes as per approved QPs, without additional charges?			

Specific to item to be supplied	
Understanding of scope of work	
Availability and understanding of related standards.	
Capacity of the Subcontractor to inspect/test the work/item	
Understanding of special Examination/testing ( <i>e.g Ultrasonic Examination/ Helium Leak testing etc. as applicable</i> )	
Availability of special facilities required for the item	
Availability of trained personnel specific to item to be supplied	
Availability of inspection/test facilities	
Availability of QP and procedures	
Independence of Head of QA/QC group	
Availability of test reports for the item/items for the past 1 year	

Submitted by (Subcontractor)	Signature,(with name, designation and date)
Assessed and forwarded to NPCIL (Contractor: Head QA & PE )	Signature,(with name, designation and date)

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## VOLUME - IA PART – I CHAPTER – XVI

### TENTATIVE WEIGHT SCHEDULE FOR SEA WATER PIPING PACKAGE FOR UNIT 3 & 4 (NPCIL & BHEL FREE ISSUE MATERIAL - FIM)

TENTATIVE WEIGHT SCHEDULE FOR SEA WATER PIPING PACKAGE (FIM by NPCIL) FOR UNIT 3 & 4				
S.No.	Particulars	UOM	QTY PER UNIT	QTY FOR TWO UNITS
1	Pipes, pipe blocks, fittings, accessories	MT	296	592
2	Valves	MT	58	116
3	Pipe Supports & its associated structural components.	MT	23	45

TENTATIVE WEIGHT SCHEDULE FOR SEA WATER PIPING PACKAGE UNIT 3 & 4. (FIM BY BHEL UNITS)									
BHEL Manufacturing Unit	Description	UOM	SYSTEM						TOTAL MT
			PEB	PUQ	PGB	GKD	GML	HDPE	
PIPING CENTER	CS Pipe	MT	1373	13	138	7	46		1577
	SS Pipe	MT		1					1
	Pipe Supports	MT	121	1				14	136

BHEL Manufacturing Unit	Description	UOM	Qty
PEM	HDPE Pipes & Fittings	MT	300
	Butterfly valves	MT	3
Trichy Valves	Valves for GKD, PUQ & GML System	MT	4
PSSR	Fabrication & Erection of Structural steel	MT	200

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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**This section provides list of Free Issue Materials (FIM BY NPCIL) to be issued to the contractor for erection. The list contains the following groups in sequence**

<b>S.No</b>	<b>Description</b>
1	List of Pipelines in MT system wise
2	List of pipelines in MT (size & system wise)
3	List of Valves in Nos. System wise
4	List of Valves in Nos. (size & system wise)
5	List of Supports in Kg. (size & system wise)

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

List of Pipelines in MT System wise as FIM by NPCIL in IN SEA WATER PIPING PACKAGE OF UNIT 3 & 4			
System KKS code	Material	Building	Weight in MT
PEB	CS	UQC	10
PCB 70-76	CS	UQX	8
PCB 51 & 52	CS	UQA	6
PCB (non-essential load)	CS	UQA	52
PUA	CS	UQA	2
PUK	CS	UQA	3
PUJ	CS	UQA	1
PUL	CS	UPX	26
PUN	CS	UQA	1
PUS	CS	UQA/UPX	11
PUM	CS	UPX	10
PGB	CS	UQA	31
PUV	CS	UQA/UQC	5
PCB51&52, 05UKD	CS	05UKD	4
SCD	CS	UQA/UQC	1
PUD	CS	UQC	8
PUP	CS	UQC	9
PEB UKD	CS	UKD	31
PEB UKA	CS	UKA	18
PAB 89	CS	Buried	35
GQD & PCD	CS	UGW	5
GAC	CS	UQC	4.3
PAC	SS	UQA	7
PEB	Ti	UQC	1
PCB 51 & 52	Ti	UQA	0.01
PUA	Ti	UQA	0.01
PUK	Ti	UQA	0.03
PUJ	Ti	UQA	0.04
PUN	Ti	UQA	0.01
PUS	Ti	UQA/UPX	0.33
PCB51&52, 05UKD	Ti	05UKD	0.02
PUP	Ti	UQC	0.01
PEB UKA	Ti	UKA	0.08
PAB (SWS)	Ti	UQA	0.24
PUE	Ti	UQC	0.22
PUT	Ti	UPX	0.07
PEY	Ti	UQA/UPX	0.07
PUS	GRP/FRP	UQA/UPX	5.20
Total Wt of CS pipeline (MT)			281
Total Wt of SS pipeline (MT)			7
Total Wt of Ti pipeline (MT)			2.1
Total Wt of GRP/FRP pipeline (MT)			5.2
Total Qty per Unit in MT			296
Total Qty for Two Units in MT			591

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

				List of pipelines in MT (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4																			
Pipe OD (mm)				10	12	14	16	18	20	25	28	30	32	34	38	40	45	55	57	65	76	89	108
Thks range (mm)		System wise (MT)		2	2-3.5	2	2	2 - 4	2 - 3	2-3	3	3.5-4	2 - 3.5	3-6.7	2 - 3.5	3-6.7	2 - 3	9	3 - 5.5	3.5	3 - 7	4.5 - 8	4-8
System KKS code	Material	Building		MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT
PEB	CS	UQC	9.936																				
PCB 70-76	CS	UQX	8																				
PCB 51 & 52	CS	UQA	6																				
PCB (non-essential lo	CS	UQA	52.478										0.154		0.175		0.051		0.098				
PUA	CS	UQA	1.5																				
PUK	CS	UQA	3																				
PUJ	CS	UQA	1																				
PUL	CS	UPX	25.6																				
PUN	CS	UQA	1																				
PUS	CS	UQA/UPX	10.6																				1.6
PUM	CS	UPX	10.1																				8.6
PGB	CS	UQA	31.1																				
PUV	CS	UQA/UQC	5.4										0.2		1.7				3.5				
PCB51&52, 05UKD	CS	05UKD	3.7																				0.2
SCD	CS	UQA/UQC	1.2			0.1			0.1	0.3			0.7										
PUD	CS	UQC	8.1																				
PUP	CS	UQC	9																				
PEB UKD	CS	UKD	31.3																				
PEB UKA	CS	UKA	18																				
PAB 89	CS	Buried	35																				
GQD & PCD	CS	UGW	4.85			0.05									0.05				0.5			0.75	2.6

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

				List of pipelines in MT (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4																			
Pipe OD (mm)				10	12	14	16	18	20	25	28	30	32	34	38	40	45	55	57	65	76	89	108
Thks range (mm)		System wise (MT)		2	2-3.5	2	2	2 - 4	2 - 3	2-3	3	3.5-4	2 - 3.5	3-6.7	2 - 3.5	3-6.7	2 - 3	9	3 - 5.5	3.5	3 - 7	4.5 - 8	4-8
System KKS code	Material	Building		MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT
GAC	CS	UQC	4.27																0.52				
PAC	SS	UQA	7							2										2.5		2.5	
PEB	Ti	UQC	0.852			0.031							0.289		0.215		0.255		0.062				
PCB 51 & 52	Ti	UQA	0.009			0.009																	
PUA	Ti	UQA	0.012																0.012				
PUK	Ti	UQA	0.032																0.032				
PUJ	Ti	UQA	0.042																0.042				
PUN	Ti	UQA	0.006																0.006				
PUS	Ti	UQA/UPX	0.33						0.038				0.135		0.0045		0.04		0.113				
PCB51&52, 05UKD	Ti	05UKD	0.0165			0.0165																	
PUP	Ti	UQC	0.013			0.013																	
PEB UKA	Ti	UKA	0.0794																0.0164				
PAB (SWS)	Ti	UQA	0.244												0.244								
PUE	Ti	UQC	0.216																0.216				
PUT	Ti	UPX	0.066																0.066				
PEY	Ti	UQA/UPX	0.074			0.074																	
PUS	GRP/FRP	UQA/UPX	5.2																				
Total Wt of CS pipeline (MT)			281.13	0.00	0.00	0.15	0.00	0.00	0.10	0.30	0.00	0.00	1.05	0.00	1.93	0.00	0.05	0.00	4.62	0.00	0.00	0.75	13.00
Total Wt of SS pipeline (MT)			7.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	2.50	0.00
Total Wt of Ti pipeline (MT)			1.99	0.00	0.00	0.14	0.00	0.00	0.04	0.00	0.00	0.00	0.42	0.00	0.46	0.00	0.30	0.00	0.57	0.00	0.00	0.00	0.00
Total Wt of GRP/FRP pipeline (MT)			5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Qty per Unit in MT			295	0	0	0	0	0	0	2	0	0	1	0	2	0	0	0	5	3	0	3	13
Total Qty for Two Units in MT			591	0	0	1	0	0	0	5	0	0	3	0	5	0	1	0	10	5	0	7	26

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[illegible]

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

			List of pipelines in MT (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4																							
Pipe OD (mm)			125	133	159	219	273	325	377	426	465	530	630	720	820	920	1020	1140	1200	1220	1420	1848	2060	2420		
Thks range (mm)		System wise (MT)	4.5-6	5.00	5 - 7	7 - 12	5 - 11	8 - 12	6 - 9	8 - 10	10.5-16	8 - 10	8 - 25	8.00	9.00	10.5-20	9.5-10	20	9 -11	12-16	10-16	24	24	14		
System KKS code	Material	Building	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT		
GAC	CS	UQC			3.7																					
PAC	SS	UQA																								
PEB	Ti	UQC																								
PCB 51 & 52	Ti	UQA																								
PUA	Ti	UQA																								
PUK	Ti	UQA																								
PUJ	Ti	UQA																								
PUN	Ti	UQA																								
PUS	Ti	UQA/UPX																								
PCB51&52, 05UKD	Ti	05UKD																								
PUP	Ti	UQC																								
PEB UKA	Ti	UKA			0.063																					
PAB (SWS)	Ti	UQA																								
PUE	Ti	UQC																								
PUT	Ti	UPX																								
PEY	Ti	UQA/UPX																								
PUS	GRP/FRP	UQA/UPX			5.2																					
Total Wt of CS pipeline (MT)			0.00	0.90	17.30	38.02	1.50	36.20	5.30	27.50	0.00	37.00	9.92	19.70	4.20	0.00	8.00	0.00	0.00	53.60	0.00	0.00	0.00	0.00		
Total Wt of SS pipeline (MT)			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Total Wt of Ti pipeline (MT)			0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Total Wt of GRP/FRP pipeline (MT)			0.00	0.00	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Total Qty per Unit in MT			0	1	23	38	2	36	5	28	0	37	10	20	4	0	8	0	0	54	0	0	0	0		
Total Qty for Two Units in MT			0	2	45	76	3	72	11	55	0	74	20	39	8	0	16	0	0	107	0	0	0	0		

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

List of Valves in Nos. System wise as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4

System KKS code	Material	Building	Nos.
GCB	CI	SWS	4
GKD	CS	UQA	3
GQD	CS	UQA	25
GQD	CI	UQA	16
PAB	Ti	UQA	18
PAC	SS	UQA	6
PAC	Ti	UQA	6
PCB	CS	UQA/05UKD	45
PCB	SS	UQA	28
PCB	Ti	UQA/05UKD	44
PCC	CS	UQA	6
PCC	Ti	UQA	111
PCD	CS	UQA	2
PCD	CI	UQA	4
PDB	CS	UQA	7
PDB	Ti	UQA	13
PEB	CS	UQC/UKD/UKA	16
PEB	SS	UQC/UKD/UKA	61
PEB	Ti	UQC/UKD/UKA	16
PEB	PP	UQC/UKD/UKA	28
PEC	CS	UQC	12
PEC	Ti	UQC	136
PEX	CS	UQA/UPX	6
PGB	CS	UQA	48
PUA	CS	UQA	3
PUA	SS	UQA	2
PUA	Ti	UQA	3
PUD	CS	UQC	16
PUD	SS	UQC	8
PUE	Ti	UQC	24
PUJ	CS	UQA	6
PUJ	SS	UQA	4
PUJ	Ti	UQA	8
PUK	CS	UQA	10
PUK	SS	UQA	4
PUK	Ti	UQA	8
PUL	CS	UPX	1
PUL	SS	UPX	9
PUL	Ti	UPX	6
PUM	CS	UPX	27
PUN	CS	UQA	3
PUN	SS	UQA	2
PUN	Ti	UQA	3
PUP	CS	UQC	7
PUP	SS	UQC	4
PUP	Ti	UQC	7
PUS	CS	UQA/UPX	13
PUS	Ti	UQA/UPX	37
PUT	Ti	UPX	10
PUV	CS	UQA/UQC	14
PUV	SS	UQA/UQC	78
PUV	Brass	UQA/UQC	10
SCD	CS	UQA/UQC	38
SCD	SS	UQA/UQC	4
SCD	Brass	UQA/UQC	29
GAC	CS		7
GAC	Ti		8
Total Valves Per Unit			1074
Total Valves for Two Units			2148
Total Tonnage for Two Units (Approx)			116 MT

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# TECHNICAL CONDITIONS OF CONTRACT (TCC)

					List of Valves in Nos. (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4																				
Size DN (mm)					10	14	15	18	20	25	28	32	38	40	50	57	65	70	76	80	89	100	108	133	150
System KKS code	Packag e	Material	Building	System wise (nos.)	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.
PUJ	SWS	CS	UQA	6																					
PUJ	SWS	SS	UQA	4																					
PUJ	SWS	Ti	UQA	8			4								4										
PUK	SWS	CS	UQA	10																					6
PUK	SWS	SS	UQA	4																					
PUK	SWS	Ti	UQA	8			4								4										
PUL	SWS	CS	UPX	1																		1			
PUL	SWS	SS	UPX	9																					
PUL	SWS	Ti	UPX	6			6																		
PUM	SWS	CS	UPX	27			17								2							6			
PUN	SWS	CS	UQA	3																					
PUN	SWS	SS	UQA	2																					
PUN	SWS	Ti	UQA	3			1								2										
PUP	SWS	CS	UQC	7																		3			
PUP	SWS	SS	UQC	4																					
PUP	SWS	Ti	UQC	7			6					1													
PUS	SWS	CS	UQA/UPX	13																3		6			4
PUS	SWS	Ti	UQA/UPX	37			14			6				1	13							3			
PUT	SWS	Ti	UPX	10											10										
PUV	SWS	CS	UQA/UQC	14			2			8		4													
PUV	SWS	SS	UQA/UQC	78			2					53			23										
PUV	SWS	Brass	UQA/UQC	10			10																		
SCD	SWS	CS	UQA/UQC	38			36			2															
SCD	SWS	SS	UQA/UQC	4								4													
SCD	SWS	Brass	UQA/UQC	29			29																		
GAC	SWS	CS	UQC	8																					
GAC	SWS	Ti	UQC	7	5											2									
Total Valves Per Unit				1074	11	0	239	0	0	87	0	155	0	35	231	2	0	0	0	14	0	51	0	0	35
Total Valves for Two Units				2148	22	0	478	0	0	174	0	310	0	70	462	4	0	0	0	28	0	102	0	0	70

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# TECHNICAL CONDITIONS OF CONTRACT (TCC)

				List of Valves in Nos. (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4																		
Size DN (mm)				159	200	219	250	273	300	325	350	377	400	426	500	530	600	700	800	820	1000	1200
System KKS code	Package	Material	Building	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.	nos.
PUJ	SWS	CS	UQA		6																	
PUJ	SWS	SS	UQA		4																	
PUJ	SWS	Ti	UQA																			
PUK	SWS	CS	UQA						4													
PUK	SWS	SS	UQA						4													
PUK	SWS	Ti	UQA																			
PUL	SWS	CS	UPX																			
PUL	SWS	SS	UPX																3			6
PUL	SWS	Ti	UPX																			
PUM	SWS	CS	UPX				2															
PUN	SWS	CS	UQA						3													
PUN	SWS	SS	UQA						2													
PUN	SWS	Ti	UQA																			
PUP	SWS	CS	UQC		4																	
PUP	SWS	SS	UQC		4																	
PUP	SWS	Ti	UQC																			
PUS	SWS	CS	UQA/UPX																			
PUS	SWS	Ti	UQA/UPX																			
PUT	SWS	Ti	UPX																			
PUV	SWS	CS	UQA/UQC																			
PUV	SWS	SS	UQA/UQC																			
PUV	SWS	Brass	UQA/UQC																			
SCD	SWS	CS	UQA/UQC																			
SCD	SWS	SS	UQA/UQC																			
SCD	SWS	Brass	UQA/UQC																			
GAC	SWS	CS	UQC		8																	
GAC	SWS	Ti	UQC																			
Total Valves Per Unit				0	45	12	2	0	90	0	6	0	24	0	12	0	14	0	3	0	0	6
Total Valves for Two Units				0	90	24	4	0	180	0	12	0	48	0	24	0	28	0	6	0	0	12

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

List of Supports in Kg. (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4						
Sr. No.	KKS Code system	Pipe size (OD in mm)		Quantity per unit	Total Approx. weight per unit	Pipe category
		From	To	Nos.	Kg	
1	PCB70 &76	0	426	14	612	Big Bore
2	PCB51&52	0	325	12	491	Big Bore
3	PUA	108	325	1	124	Big Bore
4		0	56	1		Small Bore
5	PUK	108	325	4	495	Big Bore
6		108	159	6	32	Big Bore
7		0	56	4		Small Bore
8	PUJ	108	219	37	271	Big Bore
9		0	56	6	11	Small Bore
10	PUL	108	820	5	1420	Big Bore
11		108	1220	6	1231	Big Bore
12		108	108	15	185	Big Bore
13		108	1220	5	1127	Big Bore
14	PCB	108	720	3	439	Big Bore
15		108	219	20	484	Big Bore
16		108	325	3	303	Big Bore
17		108	530	4	1979	Big Bore
18		108	426	2	136	Big Bore
19		108	325	3	1427	Big Bore
20		108	159	2	47	Big Bore
21		108	108	1	24	Big Bore
22		108	159	75	349	Big Bore
23		0	56	48	194	Small Bore
24	PUS	0	32	29	239	Small Bore
25		0	25	3	21	Small Bore
26		0	45	12	40	Small Bore
27		0	89	3	62	Small Bore
28		108	108	19	142	Big Bore
29		108	133	6	80	Big Bore
30	PUM	0	14	11	61	Small Bore
31		108	108	66	1807	Big Bore
32		108	273	11	234	Big Bore
33		108	325	2	41	Big Bore
34	PGB	108	720	5	376	Big Bore
35		108	530	2	112	Big Bore
36		108	530	14	458	Big Bore
37		108	426	3	113	Big Bore
38		108	377	5	203	Big Bore
39		108	325	2	43	Big Bore
40		0	57	7	59	Small Bore
41		0	38	7	52	Small Bore
42	PUV, UPX	0	38	2	22	Small Bore
43		0	32	20	115	Small Bore
44		0	18	27	190	Small Bore
45	PUV, UQC	0	38	64	445	Small Bore
46	PUV, UQA	0	57	125	360	Small Bore

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

List of Supports in Kg. (size & system wise) as FIM by NPCIL in SEA WATER PIPING PACKAGE OF UNIT 3 & 4							
Sr. No.	KKS Code system	Pipe size (OD in mm)		Quantity per unit	Total Approx. weight per unit	Pipe category	
		From	To	Nos.	Kg		
47	PUD	108	159	4	136	Big Bore	
48		108	219	38	443	Big Bore	
49	PUP	108	219	23	327	Big Bore	
50		108	108	4	78	Big Bore	
51		0	89	2	29	Small Bore	
52	PEB, UQC	108	630	8	462	Big Bore	
53	PCB, 05UKD	108	219	12	288	Big Bore	
54		108	325	3	90	Big Bore	
55		108	159	5	34	Big Bore	
56		108	108	2	12	Big Bore	
57		0	57	2	14	Small Bore	
58		0	32	2	1	Small Bore	
59		0	18	3	2	Small Bore	
60		0	14	1	3	Small Bore	
61		SCD, UQA	0	40	12	107	Small Bore
62			0	32	9		Small Bore
63	0		25	9	Small Bore		
64	0		15	71	Small Bore		
65	SCD, UQC	0	32	11	60	Small Bore	
66		0	25	8		Small Bore	
67		0	15	43		Small Bore	
68	PEB, UKD	108	325	14	175	Big Bore	
69		108	219	3	90	Big Bore	
70		108	159	18	37	Big Bore	
71	PUE, UQC	0	56	42	224	Small Bore	
72		0	89	37		Small Bore	
73	PUT, UPX	0	56	14	93	Small Bore	
74	PEB10-40, UKA	108	530	25	3200	Big Bore	
75		108	325			Big Bore	
	Total Qty per Unit			1147	22561		
	Total Qty for both Units			2294	45122		

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### TENTATIVE WEIGHT SCHEDULE FOR SEA WATER PIPING PACKAGE UNIT 3 & 4. (FIM BY BHEL UNITS)

PEB SYSTEM						
PIPE SIZE	MATERIAL	MT (For 1 UNIT)	APPROX NO OF SITE JOINTS FOR 1 UNIT	MT (For 2 UNITS)	APPROX NO OF SITE JOINTS FOR 2 UNITS	JOINT TYPE
OD 630X12	CS	517	340	1035	680	WELD JOINT
OD 530X12	CS	72	96	144	192	FLANGE JOINT (Flanges will be supplied as loose - Approx 384 nos)
OD 406.4X12.7	CS	97	111	194	222	FLANGE JOINT (Flanges will be supplied as loose - Approx 444 nos)
APPROX QUANTITY AND WEIGHT OF SUPPORTS IN PEB PIPING SYSTEM						
SUPPORTS	QTY OF SUPPORTS FOR 1 UNIT (IN NOS)	APPROX WT OF SUPPORTS FOR 1 UNIT (in MT)	QTY OF SUPPORTS FOR 2 UNITS (IN NOS)	APPROX WT OF SUPPORTS FOR 2 UNITS (in MT)		
OD 630X12	318	51	636	102		
OD 530X12	52	4	104	8		
OD 406.4X12.7	77	5.5	154	11		

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

PUQ SYSTEM						
PIPE SIZE	MATERIAL	MT (For 1 UNIT)	APPROX NO OF SITE JOINTS FOR 1 UNIT	MT (For 2 UNITS)	APPROX NO OF SITE JOINTS FOR 2 UNITS	TYPE OF JOINT
OD 219.1x7.04	CS	7	49	13	98	FLANGE JOINT (Flanges will be supplied as loose - Approx 196 nos)
OD 88.9x5.49	SS	0.5	30	1	60	WELD JOINT
			16		32	FLANGE JOINT (Flanges will be supplied as loose - Approx 64 nos)
APPROX QUANTITY AND WEIGHT OF SUPPORTS IN PUQ PIPING SYSTEM						
SUPPORTS	QTY OF SUPPORTS FOR 1 UNIT (IN NOS)	APPROXIMATE WEIGHT OF SUPPORTS FOR 1 UNIT (in MT)	QTY OF SUPPORTS FOR 2 UNITS (IN NOS)	APPROXIMAT E WEIGHT OF SUPPORTS FOR 2UNITS (IN KG)		
OD 219.1x7.04	20	0.25	40.00	0.50		
OD 88.9x5.49	4	0.01	8.00	0.02		

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

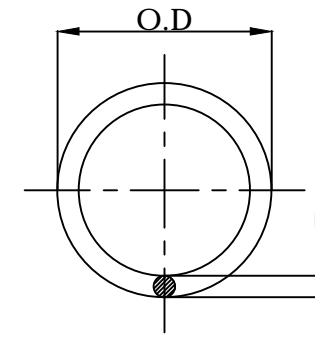
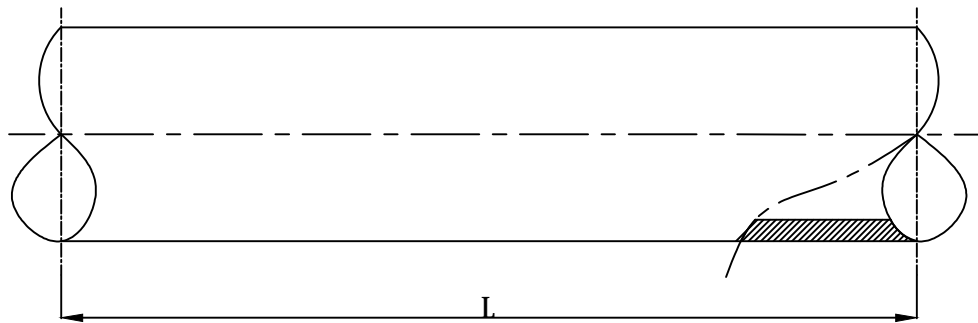
PGB SYSTEM (BURIED PIPING)						
PIPE SIZE	MATERIAL	MT (For 1 UNIT)	APPROX NO OF SITE JOINTS FOR 1 UNIT	MT (For 2 UNITS)	APPROX NO OF SITE JOINTS FOR 2 UNITS	TYPE OF JOINT
OD 720X8	CS	38	44	76	88	WELD JOINT
OD 530X8	CS	31	43	62	86	WELD JOINT

GKD SYSTEM (GALVANIZED PIPES)				
PIPE SIZE	MATERIAL	MT (For 1 UNIT)	MT (For 2 UNITS)	TYPE OF JOINT
NB32 X 4	CS	3.5	7.0	THREADED
NB50 X 4.5	CS			

GML SYSTEM						
PIPE SIZE	MATERIAL	MT (For 1 UNIT)	NO OF SITE JOINTS FOR 1 UNIT	MT (For 2 UNITS)	NO OF SITE JOINTS FOR 2 UNITS	TYPE OF JOINT
NB150 X 5.4	CS	23	50	46	100	WELD JOINT
NB15 X 3.2	CS					

Note:

1. The size, weight and joint details mentioned above are approximate and liable to vary as per design consideration. . However, payments will be made to the contractor for the tonnage actually erected at the respective category as per the quoted /accepted rate.
2. There may be variation or addition of description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted/accepted rate in the respective category.




### NOTES :

- 1) Manufacturing & Testing standard:- ISO 4427-2019
- 2) Supply length :- 6mtr tol :- + 20mm  
- 0 mm
- 3) Example of marking on Pipe:-  
Max'm Time Technoplast Limited **TIME** ISO 4427 PE-100  
SDR-11 PN 16 PCB 900 x 81.7 Batch<xxx>mm/dd/yyyy>  
KKNPP BHEL NPCIL
- 4) Maximum Out of roundness (ovality) for 900 mm  
pipe: 31.5mm
- 5) End connection - Flat pipe end with perpendicular cut
- 6) For Packing and Shipping procedures, refer Annexure-A

Sl. No	NOMINAL SIZE (MM)	PIPE OD (MM)		WALL THICKNESS (MM)		PIPE SPECIFICATION	QUANTITY (M)	APPROX WEIGHT (KG/M)	SYSTEM DESCRIPTION
		MIN	MAX	MIN	MAX				
1	900	900	908.1	81.7	90.0	AS PER ISO 4427, PE-100, SDR 11, PN16.	474	211.625	30 PCB24, 00PCB41, 40PCB24
2	630	630	633.8	57.2	63.1	AS PER ISO 4427, PE-100, SDR 11, PN16.	456	103.612	30PCB40, 40PCB40
3	560	560	563.4	50.8	56.0	AS PER ISO 4427, PE-100, SDR 11, PN16.	228	81.116	30PCB34, 40PCB34
4	500	500	503.0	45.4	50.1	AS PER ISO 4427, PE-100, SDR 11, PN16.	588	65.776	30PCB60, 30PCB61, 40PCB60, 40PCB61
5	400	400	402.4	36.3	40.1	AS PER ISO 4427, PE-100, SDR 11, PN16.	192	41.777	30PUK01, 30PUK02, 40PUK01, 40PUK02
6	400	400	402.4	29.4	32.5	AS PER ISO 4427, PE-100, SDR 13.6, PN 12.5	522	34.524	30PUA10, 40PUA10, 30PUN, 40PUN
7	355	355	357.2	32.2	35.6	AS PER ISO 4427, PE-100, SDR 11, PN16.	456	32.907	30PCB51BR001, 30PCB52BR001, 30PCB51BR002, 30PCB52BR002
8	250	250	251.5	22.7	25.1	AS PER ISO 4427, PE-100, SDR 11, PN16.	288	16.334	30PUK01, 30PUK02, 30PUJ01, 30PUJ02, 40PUK01, 40PUK02, 40PUJ01, 40PUJ02
9	180	180	181.1	16.4	18.2	AS PER ISO 4427, PE-100, SDR 11, PN16.	456	8.508	30PUK01, 30PUK02, 40PUK01, 40PUK02, 30PUQ10BR005, 30PUQ10BR006, 30PUQ20BR005, 30PUQ20BR006, 30PUQ30BR005, 30PUQ30BR006, 30PUQ40BR005, 30PUQ40BR006, 40PUQ10BR005, 40PUQ10BR006, 40PUQ20BR005, 40PUQ20BR006, 40PUQ30BR005, 40PUQ30BR006, 40PUQ40BR005, 40PUQ40BR006
10	160	160	161.0	14.6	16.2	AS PER ISO 4427, PE-100, SDR 11, PN16.	24	6.732	30PUQ10BR005, 40PUQ10BR005
11	90	90	90.6	8.2	9.2	AS PER ISO 4427, PE-100, SDR 11, PN16.	348	2.138	30PUQ10BR003, 30PUQ10BR004, 30PUQ20BR003, 30PUQ20BR004, 30PUQ30BR003, 30PUQ30BR004, 30PUQ40BR003, 30PUQ40BR004, 40PUQ10BR003, 40PUQ10BR004, 40PUQ20BR003, 40PUQ20BR004, 40PUQ30BR003, 40PUQ30BR004, 40PUQ40BR003, 40PUQ40BR004
12	63	63	63.4	5.8	6.5	AS PER ISO 4427, PE-100, SDR 11, PN16.	72	1.057	30PUQ10BR005, 40PUQ10BR005, 3GML30, 4GML40
13	32	32	32.3	3.0	3.4	AS PER ISO 4427, PE-100, SDR 11, PN16.	12	0.279	30PUQ10BR005, 40PUQ10BR005
14	20	20	20.3	2.0	2.3	AS PER ISO 4427, PE-100, SDR 11, PN16.	12	0.116	30PUQ10BR005, 40PUQ10BR005

PO no. :- P-308/20 Dtd. 12.03.2021				
BHEL Document no. : PE -VO-456-100-M201				
<b>TIME</b>		TIME TECHNOPLAST LTD. 35 Corporate Avenue, 2nd floor, Sakinaka Road, Andheri (East), Mumbai - 400 072, Maharashtra, (INDIA)		
PROJECT:-	2 x 1000 MWe KUDANKULAM NPP.			
OWNER:-	NUCLEAR POWER CORPORATION OF INDIA LTD.			
CLIENT:-	BHARAT HEAVY ELECTRICALS LTD.			
DRAWING TITLE:-	GENERAL ARRANGEMENT OF HDPE PIPES			
DRAWING NO -	TTL/BHEL/001			
DATE	REV.	DESCRIPTION	CHD.BY	APP.BY
17.03.21	0		P. TEWARI	A. KALE

	<b>Datasheet-A</b> <b>Standard Technical Specification</b> <b>2X1000MWe KKNPP</b> <b>HDPE Pipe and Fittings</b>	SPECIFICATION NO: PE-TS-456-100-M042
		REV. NO.: 0
		DATASHEET-A PART: 1 of 3

**PIPE STRAIGHT LENGTHS**

[1] Sl. No.	[2] System / Service description	[3] Standard	[4] HDPE Pipe Rating*	[5] Operating Pressure (MPa)	[6] Operating Temp (deg. C)	[7] Hydraulic Test Condition Pressure (MPa)	[8] Hydraulic Test Condition Temp (deg. C)	[9] HDPE Pipe size (OD mmX THK mm)	[10] Length (M)
1.00	30PCB & 40PCB - (R37.KK34.3.PCB.TW.OK.WD001 & R37.KK34.4.PCB.TW.OK.WD001)								
1.01	30PCB24	ISO 4427 PE-100 SDR11	PN16	0.05	38	1	19	900x81.7	132
1.02	30PCB34			0.05	38			560x50.8	114
1.03	30PCB40			0.35	31			630x57.2	132
1.04	00PCB41			0.05	38			900x81.7	210
1.05	30PCB60			0.35	31			500x45.4	156
1.06	30PCB61			0.35	31			500x45.4	138
1.07	30PCB51BR001			0.4	31			355x32.2	228
1.08	30PCB52BR001			0.4	31			355x32.2	150
1.09	30PCB51BR002			0.05	38			355x32.2	30
1.10	30PCB52BR002			0.05	38			355x32.2	48
1.11	40PCB24			0.05	38			900x81.7	132
1.12	40PCB34			0.05	38			560x50.8	114
1.13	40PCB40			0.35	31			630x57.2	324
1.14	40PCB60			0.35	31			500x45.4	156
1.15	40PCB61			0.35	31			500x45.4	138
2.00	30PUK/30PUJ & 40PUK/40PUJ (R28.KK34.30UQA.PUK.TW.OK.WD001, R28.KK34.40UQA.PUK.TW.OK.WD001)								
2.01	30PUK01	ISO 4427 PE-100 SDR11	PN16	0.44	31	0.66	10	400x36.3 250x22.7 180x16.4	54 12 12
2.02	30PUK02							400x36.3 250x22.7 180x16.4	42 12 12
2.03	30PUJ01							250x22.7	66
2.04	30PUJ02							250x22.7	54
2.05	40PUK01							400x36.3 250x22.7 180x16.4	54 12 12
2.06	40PUK02							400x36.3 250x22.7 180x16.4	42 12 12
2.07	40PUJ01							250x22.7	66
2.08	40PUJ02							250x22.7	54
3.00	30PUA & 40PUA (R28.KK34.30UQA.PUA.TW.OK.WD001 & R28.KK34.40UQA.PUA.TW.OK.WD001)								
3.01	30PUA10	ISO 4427 PE-100 SDR13.6	PN12.5	0.35	31	0.52	10	400x29.7	48
3.02	40PUA10						10	400x29.7	48
4.00	30PUN & 40PUN (R28.KK34.30UQA.PUN.TW.OK.WD001 & R28.KK34.40UQA.PUN.TW.OK.WD001)								
4.01	30PUN	ISO 4427 PE-100 SDR13.6	PN12.5	0.4	31	0.52	10	400x29.7	126
4.02	40PUN							400x29.7	300
5.00	30PUQ & 40PUQ - (R37.KK34.31UQZ.PUQ.TW.OK.WD001, R37.KK34.32UQZ.PUQ.TW.OK.WD001, R37.KK34.41UQZ.PUQ.TW.OK.WD001, R37.KK34.42UQZ.PUQ.TW.OK.WD001)								
5.01	30PUQ10BR005	ISO 4427 PE-100 SDR11	PN16				19	180x16.4	30
5.02	30PUQ10BR006							180x16.4	24
5.03	30PUQ20BR005							180x16.4	24
5.04	30PUQ20BR006							180x16.4	18
5.05	30PUQ30BR005							180x16.4	24
5.06	30PUQ30BR006							180x16.4	30
5.07	30PUQ40BR005							180x16.4	24
5.08	30PUQ40BR006							180x16.4	30
5.09	30PUQ10BR005							d160 d63 d32 d20	12 6 6 6
5.10	30PUQ10BR006							d160 d63 d32 d20	0 0 0 0
5.11	30PUQ20BR005							d160 d63 d32 d20	0 0 0 0
5.12	30PUQ20BR006							d160 d63 d32 d20	0 0 0 0
5.13	30PUQ30BR005							d160 d63 d32 d20	0 0 0 0
5.14	30PUQ30BR006							d160 d63 d32 d20	0 0 0 0

PIPE STRAIGHT LENGTHS

[1] Sl. No.	[2] System / Service description	[3] Standard	[4] HDPE Pipe Rating*	[5] Operating Pressure (MPa)	[6] Operating Temp (deg. C)	[7] Hydraulic Test Condition Pressure (MPa)	[8] Hydraulic Test Condition Temp (deg. C)	[9] HDPE Pipe size (OD mmX THK mm)	[10] Length (M)
5.15	30PUQ40BR005	ISO 4427 PE-100 SDR11	PN16	0.3	38	0.6	19	d160	0
	d63							0	
	d32							0	
	d20							0	
5.16	30PUQ40BR006							d160	0
								d63	0
								d32	0
								d20	0
5.17	40PUQ10BR005	ISO 4427 PE-100 SDR11	PN16	0.3	38	0.6	19	180x16.4	30
5.18	40PUQ10BR006							180x16.4	24
5.19	40PUQ20BR005							180x16.4	24
5.20	40PUQ20BR006							180x16.4	24
5.21	40PUQ30BR005							180x16.4	24
5.22	40PUQ30BR006							180x16.4	24
5.23	40PUQ40BR005							180x16.4	24
5.24	40PUQ40BR006							180x16.4	30
5.25	40PUQ10BR005							d160	12
								d63	6
								d32	6
								d20	6
5.26	40PUQ10BR006							d160	0
								d63	0
								d32	0
								d20	0
5.27	40PUQ20BR005							d160	0
								d63	0
								d32	0
								d20	0
5.28	40PUQ20BR006							d160	0
								d63	0
								d32	0
								d20	0
5.29	40PUQ30BR005							d160	0
								d63	0
								d32	0
								d20	0
5.30	40PUQ30BR006							d160	0
								d63	0
								d32	0
								d20	0
5.31	40PUQ40BR005							d160	0
		d63	0						
		d32	0						
		d20	0						
5.32	40PUQ40BR006	d160	0						
		d63	0						
		d32	0						
		d20	0						
5.33	30PUQ10BR003	90x8.2	30						
5.34	30PUQ10BR004	90x8.2	30						
5.35	30PUQ20BR003	90x8.2	18						
5.36	30PUQ20BR004	90x8.2	18						
5.37	30PUQ30BR003	90x8.2	24						
5.38	30PUQ30BR004	90x8.2	24						
5.39	30PUQ40BR003	90x8.2	18						
5.40	30PUQ40BR004	90x8.2	12						
5.41	40PUQ10BR003	90x8.2	30						
5.42	40PUQ10BR004	90x8.2	30						
5.43	40PUQ20BR003	90x8.2	18						
5.44	40PUQ20BR004	90x8.2	18						
5.45	40PUQ30BR003	90x8.2	24						
5.46	40PUQ30BR004	90x8.2	24						
5.47	40PUQ40BR003	90x8.2	18						
5.48	40PUQ40BR004	90x8.2	12						
6.00	GML (R28.KK34.30UQA.GML.WK.OK.WD001 & R28.KK34.40UQA.GML.WK.OK.WD001)								
6.01	3GML30	ISO 4427 PE-63 SDR11		0.3	39	0.45	20	63x5.8	30
								d32	0
								d20	0
6.02	4GML30							63x5.8	30
								d32	0
								d20	0

	Datasheet-A Standard Technical Specification 2X1000MWe KKNPP HDPE Pipe and Fittings	SPECIFICATION NO:	PE-SS-999-100-M042
		REV. NO.:	0
		DATASHEET-A PART:	2 OF 3

HDPE FITTINGS

[1] Sl. No.	[2] System / Service description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size (OD mmX THK mm)	[9] 90deg Bend (Nos.)	[10] 60deg Bend (Nos.)	[11] 45deg Bend (Nos.)	[12] 30deg Bend (Nos.)	[13] Other Bends (Nos.)	[14] Tee (Nos.)	[15] Reducer (Nos.)	[16] End Cap (Nos.)	[17] Remarks				
1.00	30PCB & 40PCB - (R37.KK34.3.PCB.TW.OK.WD001 & R37.KK34.4.PCB.TW.OK.WD001)																			
1.01	30PCB24	ISO 4427 PE-100 SDR11	0.05	38	1	19	900x81.7	4	0	2	0	-	0	-	0	-	0			
1.02	30PCB34		0.05	38			560x50.8	4	0	2	0	-	0	-	0	-	0			
1.03	30PCB40		0.35	31			630x57.2	1	0	0	0	48deg Bend 15deg Bend	2 2	-	0	-	0	-	0	
1.04	00PCB41		0.05	38			900x81.7	1	0	2	0	48deg Bend	2	-	0	-	0	-	0	
1.05	30PCB60		0.35	31			500x45.4	2	0	0	0	-	0	-	0	-	0	-	0	
1.06	30PCB61		0.35	31			500x45.4	2	0	0	0	-	0	-	0	-	0	-	0	
1.07	30PCB51BR001		0.4	31			355x32.2	3	0	0	0	-	0	-	0	-	0	-	0	
1.08	30PCB52BR001		0.4	31			355x32.2	3	0	0	0	-	0	-	0	-	0	-	0	
1.09	30PCB51BR002		0.05	38			355x32.2	0	0	0	2	-	0	-	0	-	0	-	0	
1.10	30PCB52BR002		0.05	38			355x32.2	2	0	0	0	-	0	-	0	-	0	-	0	
1.11	40PCB24		0.05	38			900x81.7	4	0	2	0	-	0	-	0	-	0	-	0	
1.12	40PCB34		0.05	38			560x50.8	4	0	2	0	-	0	-	0	-	0	-	0	
1.13	40PCB40		0.35	31			630x57.2	2	0	2	0	-	0	-	0	-	0	-	0	
1.14	40PCB60		0.35	31			500x45.4	2	0	0	0	-	0	-	0	-	0	-	0	
1.15	40PCB61		0.35	31			500x45.4	2	0	0	0	-	0	-	0	-	0	-	0	
2.00	30PUK/30PUJ & 40PUK/40PUJ (R28.KK34.30UQA.PUK.TW.OK.WD001, R28.KK34.40UQA.PUK.TW.OK.WD001)																			
2.01	30PUK01	ISO 4427 PE-100 SDR11	0.44	31	0.66	10	400x36.3 250x22.7 180x16.4	2 0 0	0 0 0	0 0 0	1 0 0	- 0 0	d400/d180 d250/d180 d180/d180	1 1 1	d400/d250 d250/d180	1 1	d180 1	1	Refer note no. 6	
2.02	30PUK02						400x36.3 250x22.7 180x16.4	2 0 0	0 0 0	1 0 0	0 0 0	- 0 0	d400/d180 d250/d180 d180/d180	1 1 1	d400/d250 d250/d180	1 1	d180 1	1	Refer note no. 6	
2.03	30PUJ01						250x22.7	6	0	2	0	-	0	-	0	d250/d180	1	-	0	
2.04	30PUJ02						250x22.7	6	0	2	2	-	0	-	0	d250/d180	1	-	0	
2.05	40PUK01						400x36.3 250x22.7 180x16.4	2 0 0	0 0 0	0 0 0	1 0 0	- 0 0	d400/d180 d250/d180 d180/d180	1 1 1	d400/d250 d250/d180	1 1	d180 1	1	Refer note no. 6	
2.06	40PUK02						400x36.3 250x22.7 180x16.4	2 0 0	0 0 0	1 0 0	0 0 0	- 0 0	d400/d180 d250/d180 d180/d180	1 1 1	d400/d250 d250/d180	1 1	d180 1	1	Refer note no. 6	
2.07	40PUJ01						250x22.7	6	0	2	0	-	0	-	0	d250/d180	1	-	0	
2.08	40PUJ02						250x22.7	6	0	2	2	-	0	-	0	d250/d180	1	-	0	
3.00	30PUA & 40PUA (R28.KK34.30UQA.PUA.TW.OK.WD001 & R28.KK34.40UQA.PUA.TW.OK.WD001)																			
3.01	30PUA10	ISO 4427 PE-100	0.35	31	0.52	10	400x29.7	3	0	2	3	17deg Bend	1	-	0	-	0	-	0	
3.02	40PUA10						400x29.7	3	0	2	3	17deg Bend	1	-	0	-	0	-	0	
4.00	30PUN & 40PUN (R28.KK34.30UQA.PUN.TW.OK.WD001 & R28.KK34.40UQA.PUN.TW.OK.WD001)																			
4.01	30PUN	ISO 4427 PE-100	0.4	31	0.52	10	400x29.7	3	0	2	0	-	0	-	0	-	0	-	0	
4.02	40PUN						400x29.7	3	0	2	0	-	0	-	0	-	0	-	0	
5.00	30PUQ & 40PUQ - (R37.KK34.31UQZ.PUQ.TW.OK.WD001, R37.KK34.32UQZ.PUQ.TW.OK.WD001, R37.KK34.41UQZ.PUQ.TW.OK.WD001, R37.KK34.42UQZ.PUQ.TW.OK.WD001)																			
5.01	30PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	Refer note 8.i.c
5.02	30PUQ10BR006						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.03	30PUQ20BR005						180x16.4	5	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.04	30PUQ20BR006						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.05	30PUQ30BR005						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.06	30PUQ30BR006						180x16.4	7	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.07	30PUQ40BR005						180x16.4	7	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.08	30PUQ40BR006						180x16.4	5	0	2	0	-	0	-	0	d180/d160	1	-	0	


HDPE FITTINGS																				
[1] Sl. No.	[2] System / Service description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size (OD mmX THK mm)	[9] 90deg Bend (Nos.)	[10] 60deg Bend (Nos.)	[11] 45deg Bend (Nos.)	[12] 30deg Bend (Nos.)	[13] Other Bends (Nos.)		[14] Tee (Nos.)		[15] Reducer (Nos.)		[16] End Cap (Nos.)		[17] Remarks
5.09	30PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.10	30PUQ10BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.11	30PUQ20BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.12	30PUQ20BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.13	30PUQ30BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.14	30PUQ30BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.15	30PUQ40BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.16	30PUQ40BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.17	40PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	Refer note 8.i.c
5.18	40PUQ10BR006						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.19	40PUQ20BR005						180x16.4	5	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.20	40PUQ20BR006						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.21	40PUQ30BR005						180x16.4	6	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.22	40PUQ30BR006						180x16.4	7	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.23	40PUQ40BR005						180x16.4	7	0	0	0	-	0	-	0	d180/d160	1	-	0	
5.24	40PUQ40BR006						180x16.4	5	0	2	0	-	0	-	0	d180/d160	1	-	0	
5.25	40PUQ10BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.26	40PUQ10BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.27	40PUQ20BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.28	40PUQ20BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	
5.29	40PUQ30BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	1 1	d160 1	1	

HDPE FITTINGS

[1] Sl. No.	[2] System / Service description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size (OD mmX THK mm)	[9] 90deg Bend (Nos.)	[10] 60deg Bend (Nos.)	[11] 45deg Bend (Nos.)	[12] 30deg Bend (Nos.)	[13] Other Bends (Nos.)		[14] Tee (Nos.)		[15] Reducer (Nos.)		[16] End Cap (Nos.)		[17] Remarks	
5.30	40PUQ30BR006	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	d160 1	1			
5.31	40PUQ40BR005						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	d160 1	1				
5.32	40PUQ40BR006						d160 d63 d32 d20	0 1 0 0	0 0 0 0	0 0 0 0	- 0	0	d160/d63 1	1	d63/d32 d32/d20 1 1	d160 1	1				
5.33	30PUQ10BR003						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.34	30PUQ10BR004						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.35	30PUQ20BR003						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.36	30PUQ20BR004						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.37	30PUQ30BR003						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.38	30PUQ30BR004						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.39	30PUQ40BR003						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.40	30PUQ40BR004						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.41	40PUQ10BR003						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.42	40PUQ10BR004						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.43	40PUQ20BR003						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.44	40PUQ20BR004						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.45	40PUQ30BR003						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.46	40PUQ30BR004						90x8.2	5	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.47	40PUQ40BR003						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
5.48	40PUQ40BR004						90x8.2	4	0	0	0	- 0	0	- 0	0	- 0	0 0	- 0	0 0		
6.00	GML (R28.KK34.30UQA.GML.WK.OK.WD001 & R28.KK34.40UQA.GML.WK.OK.WD001)																				
6.01	3GML30	ISO 4427 PE-100 SDR11	0.3	39	0.45	20	63x5.8 d32 d20	5 2 0	0 0 0	0 0 0	0 0 0	- 0	0	d63/d63 d63/d32 1 2	1 2	d63/d90 d32/d20 6 2	- 2	0 0			
6.02	4GML30						63x5.8 d32 d20	5 2 0	0 0 0	0 0 0	0 0 0	- 0	0	d63/d63 d63/d32 1 2	1 2	d63/d90 d32/d20 6 2	- 2	0 0			

<div><div></div><div></div></div>		Datasheet-A Standard Technical Specification 2X1000MWe KKNPP HDPE Pipe and Fittings					SPECIFICATION NO: PE-SS-999-100-M042								
							REV. NO.: 0								
							DATASHEET-A PART: 3 OF 3								
TRANSITION															
[1] Sl. No.	[2] System description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size	[9] Size of Metal connecting pipe	[10] Quantity (Nos.)	[11] Remarks					
1.00	30PCB & 40PCB - (R37.KK34.3.PCB.TW.OK.WD001 & R37.KK34.4.PCB.TW.OK.WD001)														
1.01	30PCB24	ISO 4427 PE-100 SDR11	0.05	38	1	19	900x81.7	-	-	-					
1.02	30PCB34		0.05	38			560x50.8	-	-						
1.03	30PCB40		0.35	31			630x57.2	-	-						
1.04	40PCB41		0.05	38			900x81.7	-	-						
1.05	30PCB60		0.35	31			500x45.4	-	-						
1.06	30PCB61		0.35	31			500x45.4	-	-						
1.07	30PCB51BR001		0.4	31			355x32.2	-	-						
1.08	30PCB52BR001		0.4	31			355x32.2	-	-						
1.09	30PCB51BR002		0.05	38			355x32.2	-	-						
1.10	30PCB52BR002		0.05	38			355x32.2	-	-						
1.11	40PCB24		0.05	38			900x81.7	-	-						
1.12	40PCB34		0.05	38			560x50.8	-	-						
1.13	40PCB40		0.35	31			630x57.2	-	-						
1.14	40PCB60		0.35	31			500x45.4	-	-						
1.15	40PCB61		0.35	31			500x45.4	-	-						
2.00	30PUK/30PUJ & 40PUK/40PUJ (R28.KK34.30UQA.PUK.TW.OK.WD001, R28.KK34.40UQA.PUK.TW.OK.WD001)														
2.01	30PUK01	ISO 4427 PE-100 SDR11	0.44	31	0.66	10	400x36.3	325x8	1	Flange assembly. Refer note no.6					
							250x22.7	-	-						
							180x16.4	159x4	3						
2.02	30PUK02						400x36.3	325x8	1	Flange assembly					
							250x22.7	-	-						
							180x16.4	159x4	3						
2.03	30PUJ01						250x22.7	219x8	1	Flange assembly					
2.04	30PUJ02						250x22.7	219x8	1						
2.05	40PUK01						400x36.3	325x8	1		Flange assembly Refer note no.6				
							250x22.7	-	-						
							180x16.4	159x4	3						
2.06	40PUK02						400x36.3	325x8	1	Flange assembly Refer note no.6					
		250x22.7	-	-											
		180x16.4	159x4	3											
2.07	40PUJ01	250x22.7	219x8	1	Flange assembly										
2.08	40PUJ02	250x22.7	219x8	1											
3.00	30PUA & 40PUA (R28.KK34.30UQA.PUA.TW.OK.WD001 & R28.KK34.40UQA.PUA.TW.OK.WD001)														
3.01	30PUA10	ISO 4427 PE-100	0.35	31	0.52	10	400x29.7	325x8	1	Flange assembly 325X8: Carbon steel					
3.02	40PUA10						400x29.7	325x8	1						
4.00	30PUN & 40PUN (R28.KK34.30UQA.PUN.TW.OK.WD001 & R28.KK34.40UQA.PUN.TW.OK.WD001)														
4.01	30PUN	ISO 4427 PE-100	0.4	31	0.52	10	400x29.7	325x8	2	Flange assembly 325X8: Carbon steel					
4.02	40PUN						400x29.7	325x8	2						
5.00	30PUQ & 40PUQ - (R37.KK34.31UQZ.PUQ.TW.OK.WD001, R37.KK34.32UQZ.PUQ.TW.OK.WD001, R37.KK34.41UQZ.PUQ.TW.OK.WD001, R37.KK34.42UQZ.PUQ.TW.OK.WD001)														
5.01	30PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	BFV	2	Refer note no. 8.i.a Refer note no. 8.i.b					
5.02	30PUQ10BR006						180x16.4	SCNRV	2						
5.03	30PUQ20BR005						180x16.4	BFV	2	Refer note no. 8.i.a Refer note no. 8.i.b					
5.04	30PUQ20BR006						180x16.4	SCNRV	2						
5.05	30PUQ30BR005						180x16.4	BFV	2	Refer note no. 8.i.a Refer note no. 8.i.b					
5.06	30PUQ30BR006						180x16.4	SCNRV	2						
5.07	30PUQ40BR005						180x16.4	BFV	2	Refer note no. 8.i.a Refer note no. 8.i.b					
5.08	30PUQ40BR006						180x16.4	SCNRV	2						
5.09	30PUQ10BR005											d160	-	-	-
												d63	-	-	
												d32	-	-	
												d20	-	-	
5.10	30PUQ10BR006	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.11	30PUQ20BR005						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.12	30PUQ20BR006						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.13	30PUQ30BR005						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.14	30PUQ30BR006						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.15	30PUQ40BR005						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						
5.16	30PUQ40BR006						d160	-	-	-					
							d63	-	-						
							d32	-	-						
							d20	-	-						

TRANSITION										
[1] Sl. No.	[2] System description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size	[9] Size of Metal connecting pipe	[10] Quantity (Nos.)	[11] Remarks
5.17	40PUQ108R005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.18	40PUQ108R006						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.19	40PUQ208R005						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.20	40PUQ208R006						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.21	40PUQ308R005						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.22	40PUQ308R006						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.23	40PUQ408R005						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.24	40PUQ408R006						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.25	40PUQ108R005						180x16.4	BFV SCNRV	2 2	Refer note no. 8.i.a Refer note no. 8.i.b
5.26	40PUQ108R006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.27	40PUQ208R005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.28	40PUQ208R006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.29	40PUQ308R005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.30	40PUQ308R006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.31	40PUQ408R005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.32	40PUQ408R006	d160	-	-	-					
		d63	-	-						
		d32	-	-						
		d20	-	-						
5.33	30PUQ108R003	90x8.2	-	-	-					
5.34	30PUQ108R004	90x8.2	-	-						
5.35	30PUQ208R003	90x8.2	-	-						
5.36	30PUQ208R004	90x8.2	-	-						
5.37	30PUQ308R003	90x8.2	-	-						
5.38	30PUQ308R004	90x8.2	-	-						
5.39	30PUQ408R003	90x8.2	-	-						
5.40	30PUQ408R004	90x8.2	-	-						
5.41	40PUQ108R003	90x8.2	-	-						
5.42	40PUQ108R004	90x8.2	-	-						
5.43	40PUQ208R003	90x8.2	-	-						
5.44	40PUQ208R004	90x8.2	-	-						
5.45	40PUQ308R003	90x8.2	-	-						
5.46	40PUQ308R004	90x8.2	-	-						
5.47	40PUQ408R003	90x8.2	-	-						
5.48	40PUQ408R004	90x8.2	-	-						
6.00	GML (R28.KK34.30UQA.GML.WK.OK.WD001 & R28.KK34.40UQA.GML.WK.OK.WD001)									
6.01	3GML30	ISO 4427 PE-100 SDR11	0.3	39	0.45	20	DN90	Valve flange B16.5 #150	10	Flange assembly
6.02	4GML30						DN90	Valve flange B16.5 #150	10	

		Standard Technical Specification 2X1000MWe KKNPP HDPE Pipe and Fittings					SPECIFICATION NO: PE-SS-999-100-M042			
							REV. NO.: 0			
							DATASHEET-B PART: 1 OF 1			
TRANSITION										
[1] Sl. No.	[2] System description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size	[9] Size of Metal connecting pipe	[10] Quantity (Nos.)	[11] Remarks
1.00	30PCB & 40PCB - (R37.KK34.3.PCB.TW.OK.WD001 & R37.KK34.4.PCB.TW.OK.WD001)									
1.01	30PCB24	ISO 4427 PE-100 SDR11	0.05	38	1	19	900x81.7	820x12	1	Flange assembly
1.02	30PCB34		0.05	38			560x50.8	530x12	1	
1.03	30PCB40		0.35	31			630x57.2	530x12	1	
1.04	00PCB41		0.05	38			900x81.7	-	-	
1.05	30PCB60		0.35	31			500x45.4	426x12	2	
1.06	30PCB61		0.35	31			500x45.4	426x12	2	
1.07	30PCB51BR001		0.4	31			355x32.2	325x8	2	
1.08	30PCB52BR001		0.4	31			355x32.2	325x8	2	
1.09	30PCB51BR002		0.05	38			355x32.2	325x8	1	
1.10	30PCB52BR002		0.05	38			355x32.2	325x8	1	
1.11	40PCB24		0.05	38			900x81.7	820x12	1	
1.12	40PCB34		0.05	38			560x50.8	530x12	1	
1.13	40PCB40		0.35	31			630x57.2	530x12	1	
1.14	40PCB60		0.35	31			500x45.4	426x12	2	
1.15	40PCB61		0.35	31			500x45.4	426x12	2	
2.00	30PUK/30PUJ & 40PUK/40PUJ (R28.KK34.30UQA.PUK.TW.OK.WD001, R28.KK34.40UQA.PUK.TW.OK.WD001)									
2.01	30PUK01	ISO 4427 PE-100 SDR11	0.44	31	0.66	10	400x36.3	-	-	-
							250x22.7	-	-	
							180x16.4	-	-	
2.02	30PUK02						400x36.3	-	-	
							250x22.7	-	-	
							180x16.4	-	-	
2.03	30PUJ01						250x22.7	-	-	
2.04	30PUJ02						250x22.7	-	-	
2.05	40PUK01						400x36.3	-	-	
							250x22.7	-	-	
							180x16.4	-	-	
2.06	40PUK02						400x36.3	-	-	
							250x22.7	-	-	
							180x16.4	-	-	
2.07	40PUJ01						250x22.7	-	-	
2.08	40PUJ02	250x22.7	-	-						
3.00	30PUA & 40PUA (R28.KK34.30UQA.PUA.TW.OK.WD001 & R28.KK34.40UQA.PUA.TW.OK.WD001)									
3.01	30PUA10	ISO 4427 PE-100	0.35	31	0.52	10	400x29.7	-	-	-
3.02	40PUA10						400x29.7	-	-	
4.00	30PUN & 40PUN (R28.KK34.30UQA.PUN.TW.OK.WD001 & R28.KK34.40UQA.PUN.TW.OK.WD001)									
4.01	30PUN	ISO 4427 PE-100	0.4	31	0.52	10	400x29.7	-	-	-
4.02	40PUN						400x29.7	-	-	
5.00	30PUQ & 40PUQ - (R37.KK34.31UQZ.PUQ.TW.OK.WD001, R37.KK34.32UQZ.PUQ.TW.OK.WD001, R37.KK34.41UQZ.PUQ.TW.OK.WD001)									
5.01	30PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	-	-	-
5.02	30PUQ10BR006						180x16.4	-	-	
5.03	30PUQ20BR005						180x16.4	-	-	
5.04	30PUQ20BR006						180x16.4	-	-	
5.05	30PUQ30BR005						180x16.4	-	-	
5.06	30PUQ30BR006						180x16.4	-	-	
5.07	30PUQ40BR005						180x16.4	-	-	
5.08	30PUQ40BR006						180x16.4	-	-	
5.09	30PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.10	30PUQ10BR006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.11	30PUQ20BR005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.12	30PUQ20BR006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.13	30PUQ30BR005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.14	30PUQ30BR006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.15	30PUQ40BR005						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	
5.16	30PUQ40BR006						d160	-	-	-
							d63	-	-	
							d32	-	-	
							d20	-	-	

TRANSITION										
[1] Sl. No.	[2] System description	[3] Standard of connecting HDPE pipe	[4] Operating Pressure (MPa)	[5] Operating Temp (deg. C)	[6] Hydraulic Test Condition Pressure (MPa)	[7] Hydraulic Test Condition Temp (deg. C)	[8] HDPE connecting Pipe Size	[9] Size of Metal connecting pipe	[10] Quantity (Nos.)	[11] Remarks
5.17	40PUQ10BR005	ISO 4427 PE-100 SDR11	0.3	38	0.6	19	180x16.4	-	-	-
5.18	40PUQ10BR006						180x16.4	-	-	-
5.19	40PUQ20BR005						180x16.4	-	-	-
5.20	40PUQ20BR006						180x16.4	-	-	-
5.21	40PUQ30BR005						180x16.4	-	-	-
5.22	40PUQ30BR006						180x16.4	-	-	-
5.23	40PUQ40BR005						180x16.4	-	-	-
5.24	40PUQ40BR006						180x16.4	-	-	-
5.25	40PUQ10BR005						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.26	40PUQ10BR006						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.27	40PUQ20BR005						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.28	40PUQ20BR006						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.29	40PUQ30BR005						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.30	40PUQ30BR006						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.31	40PUQ40BR005						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.32	40PUQ40BR006						d160 d63 d32 d20	- - - -	- - - -	- - - -
5.33	30PUQ10BR003						90x8.2	DN 80 Sh.40	1	Flange assembly
5.34	30PUQ10BR004						90x8.2	DN 80 Sh.40	1	
5.35	30PUQ20BR003						90x8.2	DN 80 Sh.40	1	
5.36	30PUQ20BR004						90x8.2	DN 80 Sh.40	1	
5.37	30PUQ30BR003						90x8.2	DN 80 Sh.40	1	
5.38	30PUQ30BR004						90x8.2	DN 80 Sh.40	1	
5.39	30PUQ40BR003						90x8.2	DN 80 Sh.40	1	
5.40	30PUQ40BR004						90x8.2	DN 80 Sh.40	1	
5.41	40PUQ10BR003						90x8.2	DN 80 Sh.40	1	
5.42	40PUQ10BR004						90x8.2	DN 80 Sh.40	1	
5.43	40PUQ20BR003						90x8.2	DN 80 Sh.40	1	
5.44	40PUQ20BR004						90x8.2	DN 80 Sh.40	1	
5.45	40PUQ30BR003						90x8.2	DN 80 Sh.40	1	
5.46	40PUQ30BR004						90x8.2	DN 80 Sh.40	1	
5.47	40PUQ40BR003						90x8.2	DN 80 Sh.40	1	
5.48	40PUQ40BR004						90x8.2	DN 80 Sh.40	1	
6.00 GML (R28.KK34.30UQA.GML.WK.OK.WD001 & R28.KK34.40UQA.GML.WK.OK.WD001)										
6.01	3GML30	ISO 4427 PE-100 SDR11	0.3	39	0.45	20	-	-	-	-
6.02	4GML30						-	-	-	

## **Drawings for pipes**

ВЕДОМОСТЬ РАБОЧИХ ЧЕРТЕЖЕЙ ОСНОВНОГО КОМПЛЕКТА  
LIST OF THE WORKING DRAWINGS OF MAIN SET

Лист Sheet	Наименование Description	Примечание Note
1	Общие данные General data	
2	Схема трубопроводов Layout of pipelines	
3	План трубопроводов Pipelines plan	
4	План разработки трубопроводов 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002 на блоки Block division plan of pipelines 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002	
5	Спецификация блоков трубопроводов 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002 Blocks specification of pipelines 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002	
6	План разработки трубопроводов 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001 на блоки Block division plan of pipelines 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001	
7	Спецификация блоков трубопроводов 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001 Blocks specification of pipelines 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001	
8	План разработки трубопроводов 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002 на блоки Block division plan of pipelines 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002	
9	Спецификация блоков трубопроводов 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002 Blocks specification of pipelines 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002	
10	План разработки трубопроводов 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001 на блоки Block division plan of pipelines 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001	
11	Спецификация блоков трубопроводов 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001 Blocks specification of pipelines 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001	
12	План расстановки опор на трубопроводах 30РЕВ10, 30РЕВ11, 30РЕВ12 Layout of supports on the pipelines 30РЕВ10, 30РЕВ11, 30РЕВ12	
13	Ведомость опор трубопроводов 30РЕВ10, 30РЕВ11, 30РЕВ12 List of supports of pipelines 30РЕВ10, 30РЕВ11, 30РЕВ12	
14	План расстановки опор на трубопроводах 30РЕВ20, 30РЕВ21, 30РЕВ22 Layout of supports on the pipelines 30РЕВ20, 30РЕВ21, 30РЕВ22	
15	Ведомость опор трубопроводов 30РЕВ20, 30РЕВ21, 30РЕВ22 List of supports of pipelines 30РЕВ20, 30РЕВ21, 30РЕВ22	
16	Установка скользящих, направляющих и неподвижных опор трубопроводов Installation of sliding, guide and fixed supports of pipelines	
17	Блоки трубопроводов 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002 Blocks of pipelines 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002	
18	Блоки трубопроводов 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001 Blocks of pipelines 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001	
19	Блоки трубопроводов 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002 Blocks of pipelines 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002	
20	Блоки трубопроводов 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001 Blocks of pipelines 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001	
21	Отводы трубопроводов 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002 Pipe-bends of pipelines 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002	
22	Отводы трубопроводов 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001 Pipe-bends of pipelines 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001	
23	Отводы трубопроводов 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002 Pipe-bends of pipelines 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002	
24	Отводы трубопроводов 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001 Pipe-bends of pipelines 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001	
25	Блок 30РЕВ10ВR002МR002 Block 30РЕВ10ВR002МR002	
26	Блок 30РЕВ10ВR001МR067 Block 30РЕВ10ВR001МR067	
27	Блок 30РЕВ20ВR002МR001 Block 30РЕВ20ВR002МR001	
28	Блок 30РЕВ20ВR001МR078 Block 30РЕВ20ВR001МR078	
29	Блоки 30РЕВ10ВR002МR038, 30РЕВ10ВR001МR1102, 30РЕВ20ВR002МR042, 30РЕВ20ВR001МR111 Blocks 30РЕВ10ВR002МR038, 30РЕВ10ВR001МR1102, 30РЕВ20ВR002МR042, 30РЕВ20ВR001МR111	
30	Блоки 30РЕВ12ВR002МR063, 30РЕВ12ВR001МR128, 30РЕВ22ВR002МR073, 30РЕВ22ВR001МR141 Blocks 30РЕВ12ВR002МR063, 30РЕВ12ВR001МR128, 30РЕВ22ВR002МR073, 30РЕВ22ВR001МR141	
31	Сварные соединения трубопроводов DN600 Welded connections of pipelines DN600	

ВЕДОМОСТЬ ОСНОВНЫХ КОМПЛЕКТОВ РАБОЧИХ ЧЕРТЕЖЕЙ  
LIST OF MAIN PACKAGES CONSISTING OF THE WORKING DRAWINGS

Обозначение Designation	Наименование Description	Примечание Note
R37.KK34.31UQZ.PEB.TW.OK.WD001	Металлические конструкции трубопроводов ответственных потребителей Metalwork Pipelines of essential services	Лист N 3 10 6 49 Package Number 3 10 6 49
R37.KK34.31UQZ.PEB.KZ.OK.WD002	Трубопроводы ответственных потребителей. Железобетонные узлы Pipelines of essential services. Reinforced concrete items	Лист N 3 10 6 49 Package Number 3 10 6 49
R37.KK34.31UQZ.PUQ.TW.OK.WD001	Система дренажа сбросных вод. Дренаж воды из туннелей в случае разрыва трубопровода Drain water removal system. Water removal from tunnels in case of pipeline break	Лист N 3 12 6 44 Package Number 3 12 6 44
102.KK34.0.PEB.TW.OK.WD001	Чертежи опор трубопроводов РЕВ в туннелях UQZ 3 и 4 энергоблоков АЭС "Куданкул" Drawings for PEB pipeline supports in UQZ tunnels of KK-3&4	

Нов.  
New

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ВЕДОМОСТЬ СПЕЦИФИКАЦИЙ  
SPECIFICATION LIST

Лист Sheet	Наименование Description	Примечание Note
5	Спецификация блоков трубопроводов 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002 Blocks specification of pipelines 30РЕВ10ВR002, 30РЕВ11ВR002, 30РЕВ12ВR002	
7	Спецификация блоков трубопроводов 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001 Blocks specification of pipelines 30РЕВ10ВR001, 30РЕВ11ВR001, 30РЕВ12ВR001	
9	Спецификация блоков трубопроводов 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002 Blocks specification of pipelines 30РЕВ20ВR002, 30РЕВ21ВR002, 30РЕВ22ВR002	
11	Спецификация блоков трубопроводов 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001 Blocks specification of pipelines 30РЕВ20ВR001, 30РЕВ21ВR001, 30РЕВ22ВR001	

Изменено по уведомлению DCN:3435-20  
Change as per DCN:3435-20

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ХИМИЧЕСКИЙ СОСТАВ МОРСКОЙ ВОДЫ  
CHEMICAL COMPOSITION OF SEA WATER

Название Element	Величина Value	Примечание Note
1 Кальций, мг/л Calcium, mg/l	360...420	
2 Магний, мг/л Magnesium, mg/l	1248...1322	
3 Натрий, мг/л Sodium, mg/l	7500...8500	
4 Калий, мг/л Potassium, mg/l	390...415	
5 Гидрокарбонаты, мг/л Hydrocarbonates, mg/l	73,2...109,8	
6 Карбонаты, мг/л Carbonates, mg/l	67,2...76,8	
7 Сульфаты, мг/л Sulphates, mg/l	2709...2761	
8 Хлориды, мг/л Chlorides, mg/l	19500	
9 Общее солесодержание, % General salt content, %	3,6	
10 Жесткость (CaCO <sub>3</sub> ), мг/л hardness, mg/l	6500	
11 Водородный показатель pH pH value	8	
12 Нерастворимые вещества, мг/л Insoluble matters, mg/l	20	
13 Биологические данные, мг/100 м <sup>3</sup> Biological assay data, mg/100 m <sup>3</sup>	70	

ТЕХНИЧЕСКАЯ ХАРАКТЕРИСТИКА И СВОДКА МАСС ТРУБОПРОВОДОВ  
PERFORMANCE AND WEIGHT DATA OF PIPELINES

Обозначение трубопровода Designation	Наименование транспортируемого продукта Description of transported matter	Подверженность Subject to	Рабочие условия трубопровода Pipeline operating conditions		Условия гидроиспытания Hydraulic test conditions		Диаметр и толщина стенок трубопровода Diameter and thickness of pipe wall Dis, mm	Масса трубопроводов, кг Pipeline weight, kg		
			Давление, МПа Pressure, MPa	Температура, °C Temperature, °C	Давление, МПа Pressure, MPa	Минимальная температура трубы, °C Minimal temperature of pipe wall, °C		Общая Total	В том числе Трубо- пробода Including Pipeline weight	Опор Support weight
30РЕВ10	Морская вода Sea water	ПНАЭ Г-7-008-89 PNAE G-7-008-89	32	19	19	19	630x12	257046,7	256340,8	10706,1
30РЕВ20			38*				280822,8	256336,8	24486,0	
30РЕВ11			32				530x12	21124,0	20198,0	926,0
30РЕВ21			38*				530x12	21173,6	20204,6	969,0
30РЕВ12			32				406,4x12,7	55952,1	54142,3	1810,0
30РЕВ22			38*				406,4x12,7	57270,3	54142,3	3128,0

\* - в режиме аварийного расхолаживания температура воды может достигать 60 °C.  
\* - water temperature can reach 60 °C in emergency cooling mode.

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УСЛОВНЫЕ ОБОЗНАЧЕНИЯ  
LEGEND

	Граница проектирования Design boundary
	Переход Adapter
	Спуск воды из трубопровода Water discharge from pipeline
	Соединение трубопроводов Connection of pipeline
	Соединение трубопроводов отсутствует No connection of pipeline
	Порядковый номер опоры Sequence number of support
	Неподвижная опора N 1 Fixed support Number 1
	Порядковый номер блока трубопровода Sequence number of pipeline block
	Направление движения среды Direction of medium motion
	Направление уклона трубопровода Pipeline pitch direction

МЕТОДЫ И ОБЪЕМЫ КОНТРОЛЯ СВАРНЫХ СОЕДИНЕНИЙ  
METHODS AND DEGREE OF INSPECTION OF WELDED JOINTS

Номер трубопровода Pipeline number	Категория сварных соединений или категория трубопровода Category of welded joints or category of pipeline	Наименование метода контроля Name of control method	Объем контроля Degree of inspection							
			Неразрушающего, % Non-destructive, %				Разрушающего Destructive			
30РЕВ10	II	Визуальный и измерительный	100	100	50	50	100	-	-	-
30РЕВ20		Гидравлические испытания	100	100	50	50	100	-	-	-

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ОБЩИЕ УКАЗАНИЯ

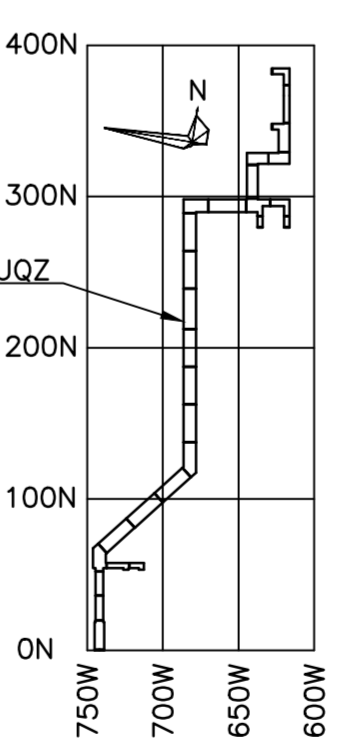
1 Рабочие чертежи разработаны в соответствии с Контрактом N 77-258/1415800 на разработку рабочей документации.  
2 Рабочая документация разработана в соответствии с Российскими нормативными документами, действующими на 15.05.2009.  
3 Классификация трубопроводов:  
- 2НО по НП-001-97 (ПНАЭ Г-01-011-97) "Общие положения обеспечения безопасности атомных станций, ОПБ-88/97";  
- группа В по ПНАЭ Г-7-008-89 "Правила устройства и безопасной эксплуатации оборудования и трубопроводов атомных энергетических установок";  
- категория сейсмостойкости I по НП-031-01 "Нормы проектирования сейсмостойких атомных станций".  
4 Расчеты трубопроводов на прочность выполнены в соответствии с ПНАЭ Г-7-002-86 "Нормы расчета на прочность оборудования и трубопроводов атомных энергетических установок".  
5 Трубопроводы прокладываются в туннелях 31UQZ с уклоном в сторону слива воды в сифонный колодец 34UQX. Величина уклона трубопроводов определяется величиной уклона дна туннелей и находится в пределах от i=0,0035 до i=0,0050.  
6 Трубопроводы прокладываются на технологических опорах (скользящих и направляющих), которые устанавливаются на опорные железобетонные подушки, (смотри комплект чертежей R37.KK34.31UQZ.PEB.KZ.OK.WD002).  
7 Компенсация температурных удлинений осуществляется за счет естественных узлов поворота трассы трубопроводов.  
Все усилия и моменты, возникающие от сочетания действующих нагрузок (осевых, боковых, весовых), воспринимаются неподвижными опорами.  
8 Опорно-ремонтные трубопроводы предусматриваются через дренажные узлы, которые устанавливаются в нижних точках трубопроводов со сбросом воды в специально предусмотренные дренажные приямки в туннелях, с последующей перекачкой воды из них в сифонный колодец 34UQX.  
Диаметр дренажных узлов принят из условия самотечного опорожнения трубопроводов в течение двух часов.  
9 Выпуск воздуха из трубопроводов в туннелях 31UQZ не предусматривается.  
10 Трубопроводы 630x12 и 530x12 изготавливаются из углеродистой стали по ASME-SA-333 Gr. 6. Трубопровод 406,4x12,7 по ASME 36.10 изготавливается из углеродистой стали по ASME-SA-106 Gr. B или ASME-SA-333 Gr. 6. Фитинги изготавливаются из углеродистой стали по ASME-SA-333 Gr. 6. Трубопроводы DN 400 изготавливаются из бесшовных труб. Трубопроводы DN 600 и DN 500 изготавливаются из электросварных труб.  
11 Монтаж трубопроводов осуществляется блоками заводского изготовления. Трубопроводы DN600 монтируются на сварке в соответствии с ПНАЭ Г-7-009-89 "Оборудование и трубопроводы атомных энергетических установок. Сварка и наладка. Основные положения". Трубопроводы DN500 и DN400 монтируются на фланцевых соединениях. Сварные соединения относятся к категории II, подкатегория IIb по ПНАЭ Г-7-010-89 "Оборудование и трубопроводы атомных энергетических установок. Сварные соединения и наладки. Правила контроля".  
Контроль качества сварных соединений по ПНАЭ Г-7-010-89 "Оборудование и трубопроводы атомных энергетических установок. Сварные соединения и наладки. Правила контроля".  
12 Трубопроводы монтируются с обязательным устройством антикоррозионного защитного покрытия внутренней и наружной поверхностей труб от воздействия морской воды и кислорода воздуха в соответствии с техническими требованиями Р28.KK36.0.0.TW.TT.WD002.

Данные работы выполняются отдельными проектами и в состав "графиков" комплекта рабочей документации не входят.  
13 Строительная часть выполняется по чертежам пакета 3 9 2 17.  
14 DCN: 3435-20 на листе 1 содержит изменения 1...9.

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СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



GENERAL GUIDELINES

1 The working drawings have been developed in accordance with basic provisions of the Contract No 77-258/1415800 on elaboration of working documentation.  
2 Working documents have been worked out in compliance with the Russian regulatory documents in force as on 15.05.2009.  
3 Pipelines classification:  
- 2NO NP-001-97 (PNAE G-01-011-97) "General Regulations on Nuclear Power Station Protection. OPB-88/97";  
- group B in compliance with PNAE G-7-008-89 "Regulations on Arrangement and safe operation of equipment and pipelines of nuclear power plants";  
- seismic stability category I in conformity with NP-031-01 "Design Standards for aseismic nuclear power stations".  
4 Pipelines strength analysis is implemented in conformity with PNAE G-7-002-86 "Strength analysis Standards for equipment and pipelines of nuclear power plants".  
5 Pipelines are to be laid out in tunnels 31UQZ with pitch towards water discharge to the siphon pit 34UQX. Pipelines gradient is determined by the tunnel floor slope and is positioned within the limits: from i=0,0035 to i=0,0050.  
6 Pipelines are to be laid out using technological supports (sliding and guide supports), that are to be installed on the reinforced bearing blocks. (Ref. Package R37.KK34.31UQZ.PEB.KZ.OK.WD002).  
7 Temperature rolling-out compensation is carried out due to natural turning angle of pipeline route.  
All the forces and moments that evolved from load combination (axial load, side load, weight bearing load) are reacted by fixed supports.  
8 Pipeline emptying is to be executed through drain modules that should be placed in lower points of pipelines and imply water discharge to the special drainage pits and then water transfer to the siphon pit 34UQX. Drainage module diameter is determined due to pipeline gravity emptying within two hours.  
9 Air discharge from the pipelines in the tunnels 31UQZ is not provided.  
10 Pipelines 630x12 and 530x12 are made of carbon steel ASME-SA-333 Gr. 6. Pipeline 406,4x12,7 according to ASME 36.10 made of carbon steel ASME-SA-106 Gr. B or ASME-SA-333 Gr. 6. The fittings are made of carbon steel in accordance with ASME SA-333 Gr. 6. Pipelines DN 400 are made of seamless pipes. Pipelines DN 600 and DN 500 are made of electric-welded pipes.  
11 Installation of pipelines is carried out by factory production units. Pipelines DN600 are installed on welding in accordance with PNAE G-7-009-89 "Equipment and pipelines of nuclear power installations. Welding and overlaying, general provisions". Pipelines DN500 and DN400 are installed on flange joints.  
Welded connections subject to category II, subcategory IIb in conformity with PNAE G-7-010-89 "Equipment and pipelines for nuclear power plants. Welding connection and surfacing. Control rules".  
Welding connections quality inspection is in conformity with PNAE G-7-010-89 "Equipment and pipelines for nuclear power plants. Welding connection and surfacing. Control rules".  
12 Pipelines are to be laid using corrosion preventing pipe coating for inside and outer pipe surfaces in order to prevent sea-water and air forcing in accordance with the technical requirements of R28.KK36.0.0.TW.TT.WD002.  
Mentioned works are to be implemented in the course of separate projects, so these works are not included in the present package of working documentation.  
13 Construction part is performed by according to package 3 9 2 17.  
14 DCN: 3435-20 on sheet 1 contains changes 1...9.

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/Package Number		3 10 6 49
R37.KK34.31UQZ.PEB.TW.OK.WD001.DCN.DSG34-3435-20		3-6
The changes have been introduced by DSG KK3-6 of JSC AEP		
31UQZ 31UQZ Metalwork Pipelines of essential services		
Sheet 1	Rev. 0	General data
Approved ZAIKA		JSC "Atomenergoproekt" Moscow 2020
Designed ZHELEZNYAKOVA		

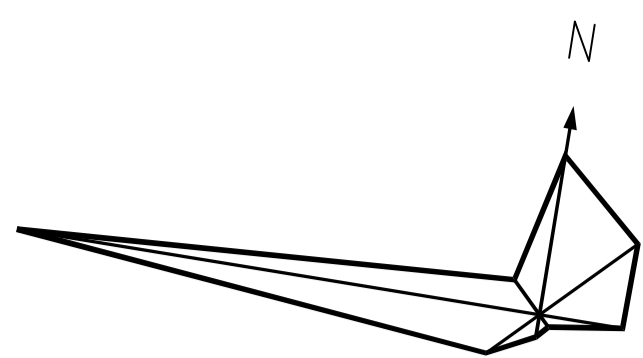


СХЕМА ТРУБОПРОВОДОВ  
LAYOUT OF PIPELINES

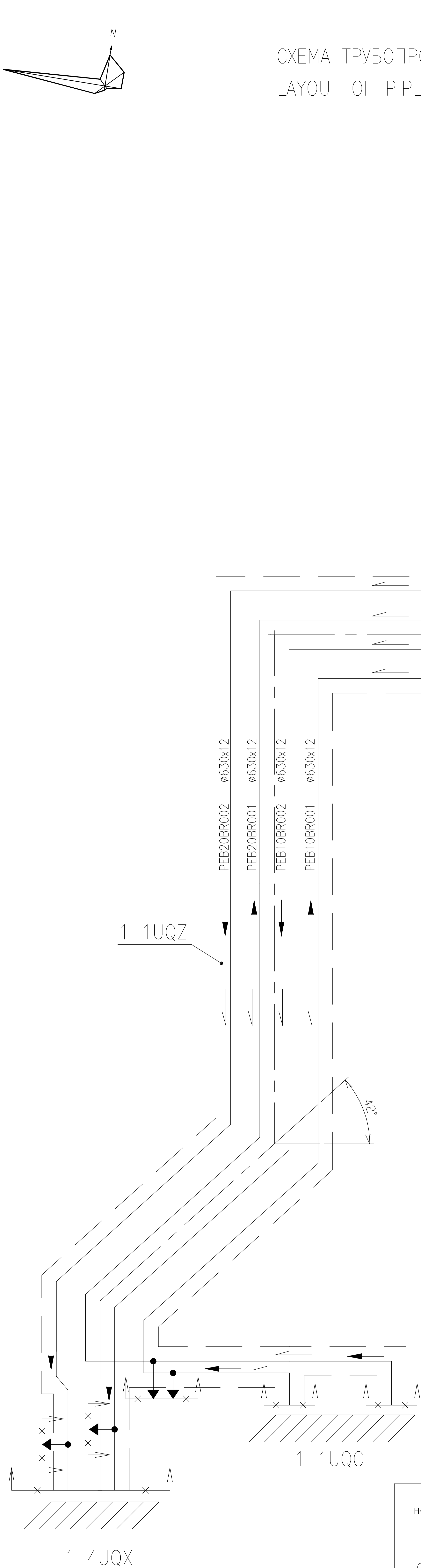
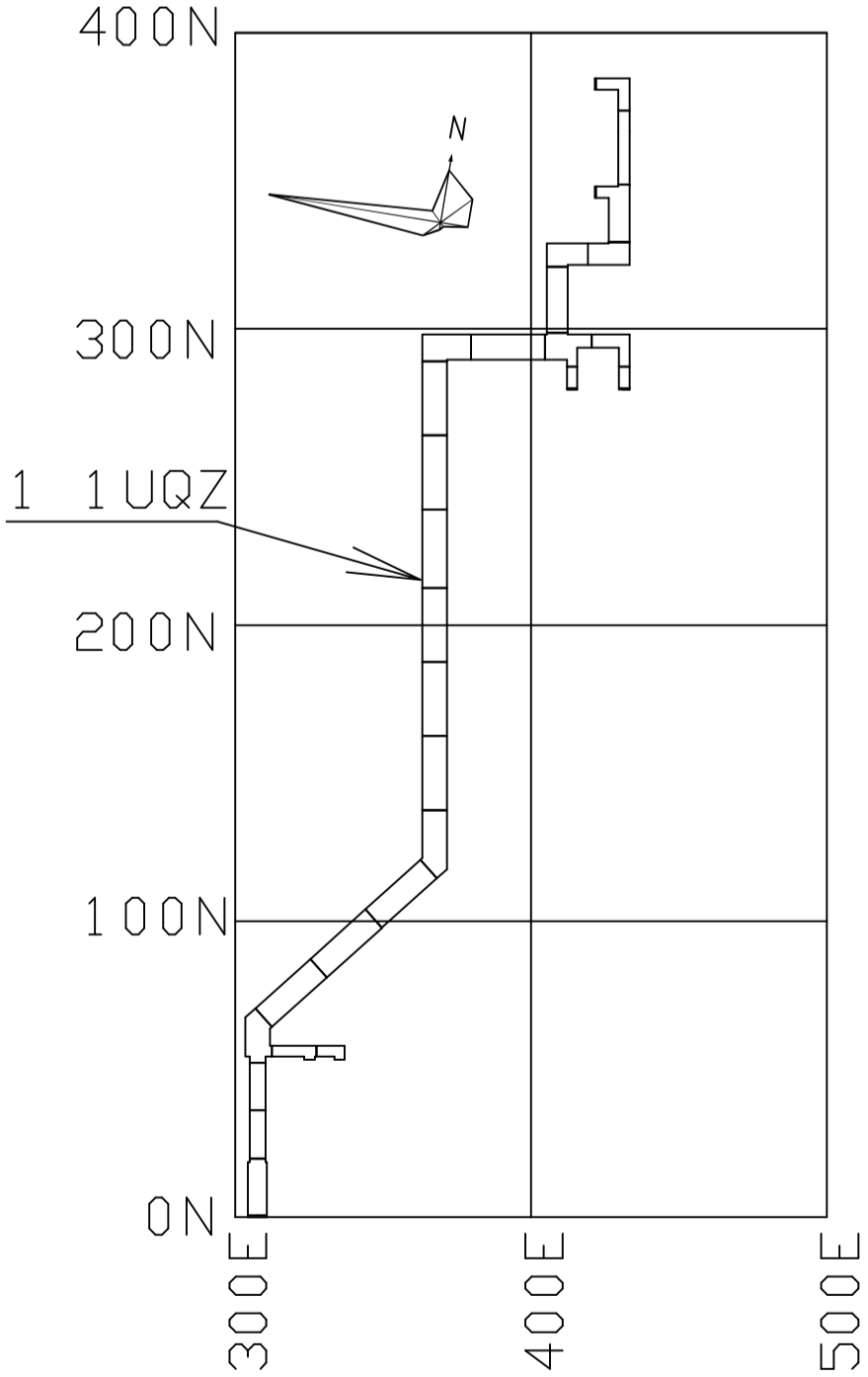


СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



Orig. arch. Nr.	Replac arch. Nr.
2613	655
Orig. arch. Nr.	Date
2613	15.03.2004

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Rev.	N pat.	Sheet	Doc. No	Signature	Date
1	-	Repl.	1-04		
Изм.	N уч.	Лист	N док.	Погнись	Дата
Утвердил	Approved	Kondratyev			
Н. контр.	Inspector	Altimova			
Разраб.	Designed	Kravchenko			

R37.KK.1 1UQZ.PEB.TW.OK.WD001			
АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT 1			
1 1UQZ Металлические конструкции трубопроводов ответственных потребителей	Стадия	Лист	Листов
	Phase	Sheet	Sheets
1 1UQZ Metalwork Pipelines of essential services	WD	2	
Схема трубопроводов Layout of pipelines	Joint-stock Company "Institute Hydroproject" Dedovsk 2004		

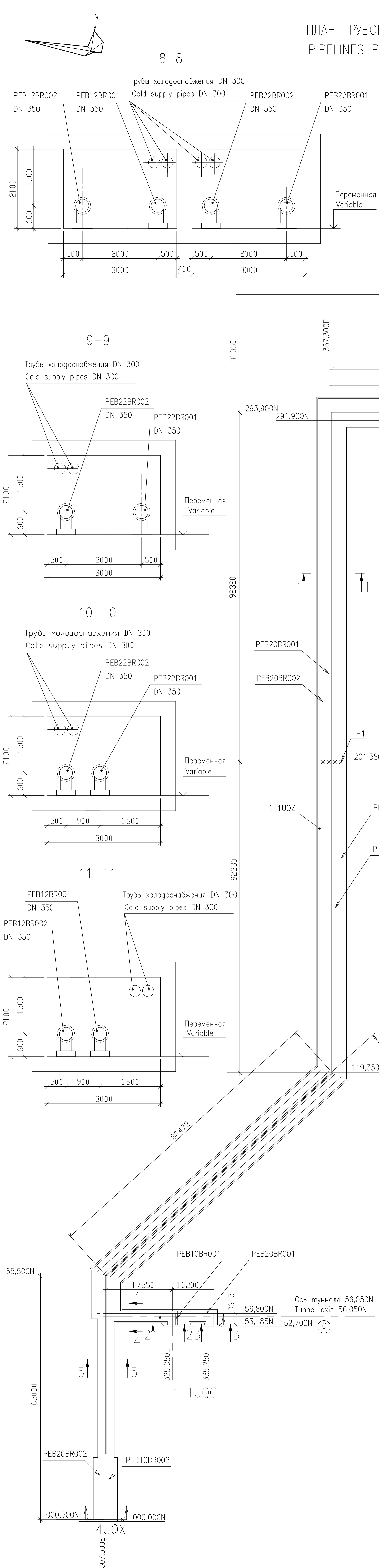
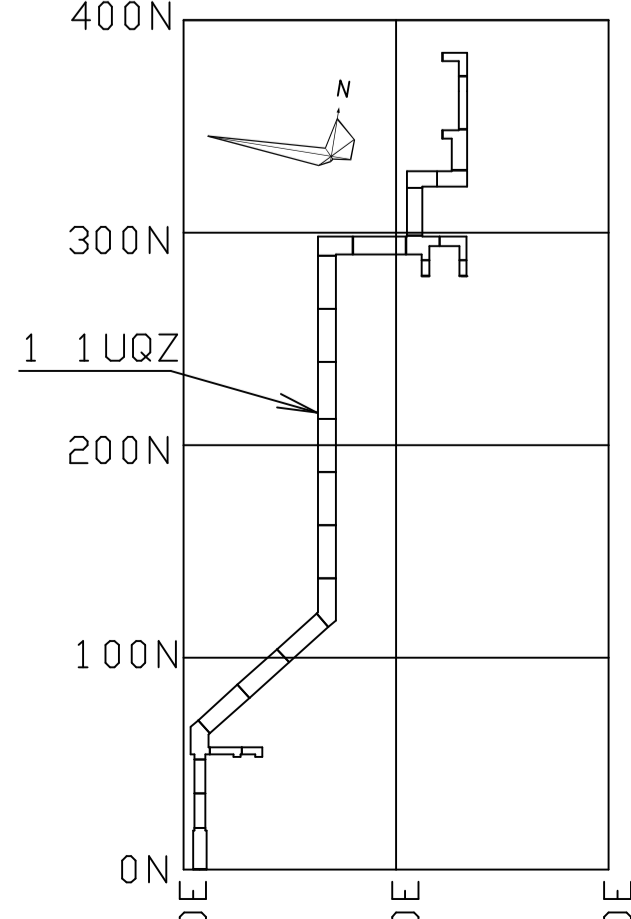
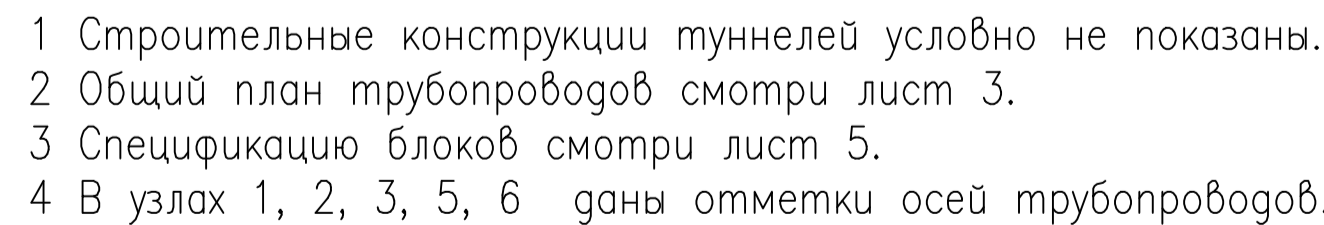
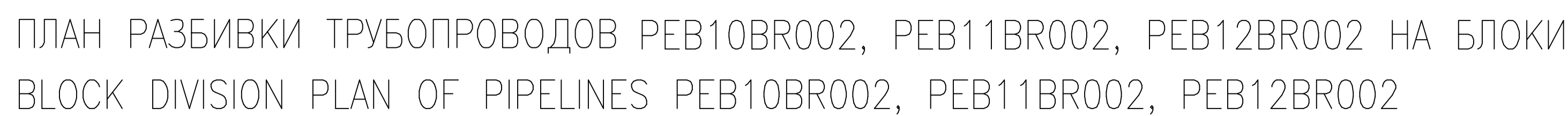


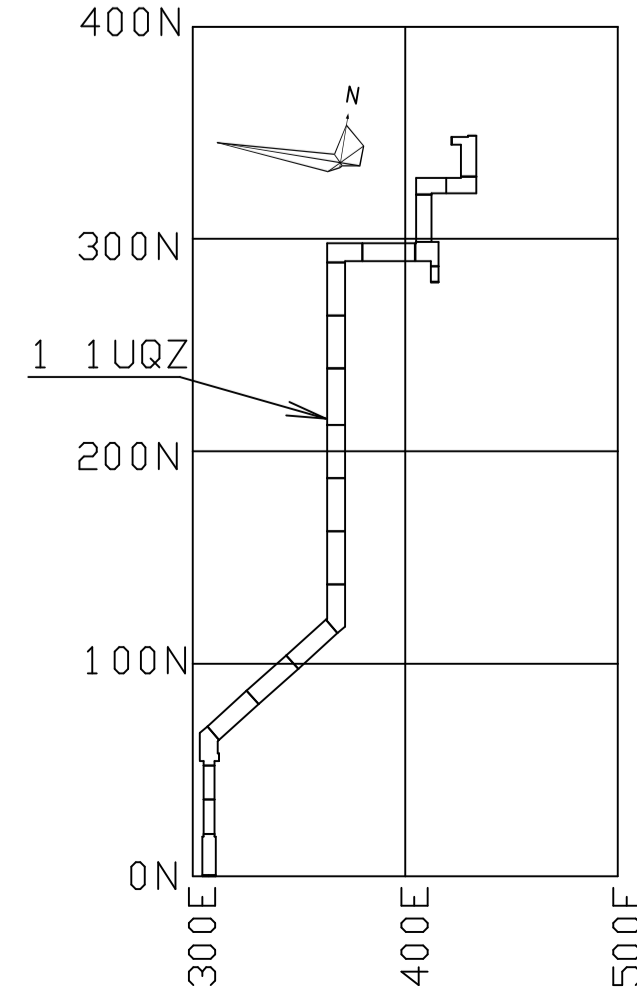
СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



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This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydproproject"						1 1UQZ Металлические конструкции трубопроводов ответственных потребителей			1 1UQZ Metalwork Pipelines of essential services		
Изм. N уч. Лист N док. Подпись Дата						Стадия			Лист		
Rev. N pat. Sheet Doc. No Signature Date						Phase			Sheet		
Умвергил Approved H. контр. Inspector Разраб. Designed						WD			3		
Ymbergil Kondratyev Alifimova Kravchenko						План трубопровода Pipelines plan			Joint-stock Company "Institute Hydproproject" Dedinok 2004		
									Формат A1		



- 1 Constructions of tunnels are not shown schematically.
- 2 General plan of pipelines (Ref. Sheet 3).
- 3 Blocks specification (Ref. Sheet 5).
- 4 In units 1, 2, 3, 5, 6 axes marks of pipelines are given.



Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлазгидропроект"							R37.KK.1 1UQZ.PEB.TW.OK.WD001 АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1	1 UQZ Металлические конструкции трубопроводов ответственных потребителей	Смагута	Лист	Листов
	1	—	Repl.	1—04							
	Изм.	N уч.	Лист	N гок.	Погнус	Дато					
	Rev.	N pat.	Sheet	Doc. No	Signature	Date					
	Умбергалл, А. Н. контр. Инспектор		Kondratyev								
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"							1 UQZ Metalwork Pipelines of essential services	Phase	Sheet	Sheets	
	WD	4									
	Умбергалл, А. Н. контр. Инспектор	Алфимова					План разбивки трубопроводов PEВ10BR002, PEВ11BR002, PEВ12BR002 на блоку	Joint-stock Company "Institute Hydroproject"	Dedovsk	2004	
	Разработ. Designed	Kravchenko					Block division plan of pipelines PEВ10BR002, PEВ11BR002, PEВ12BR002				

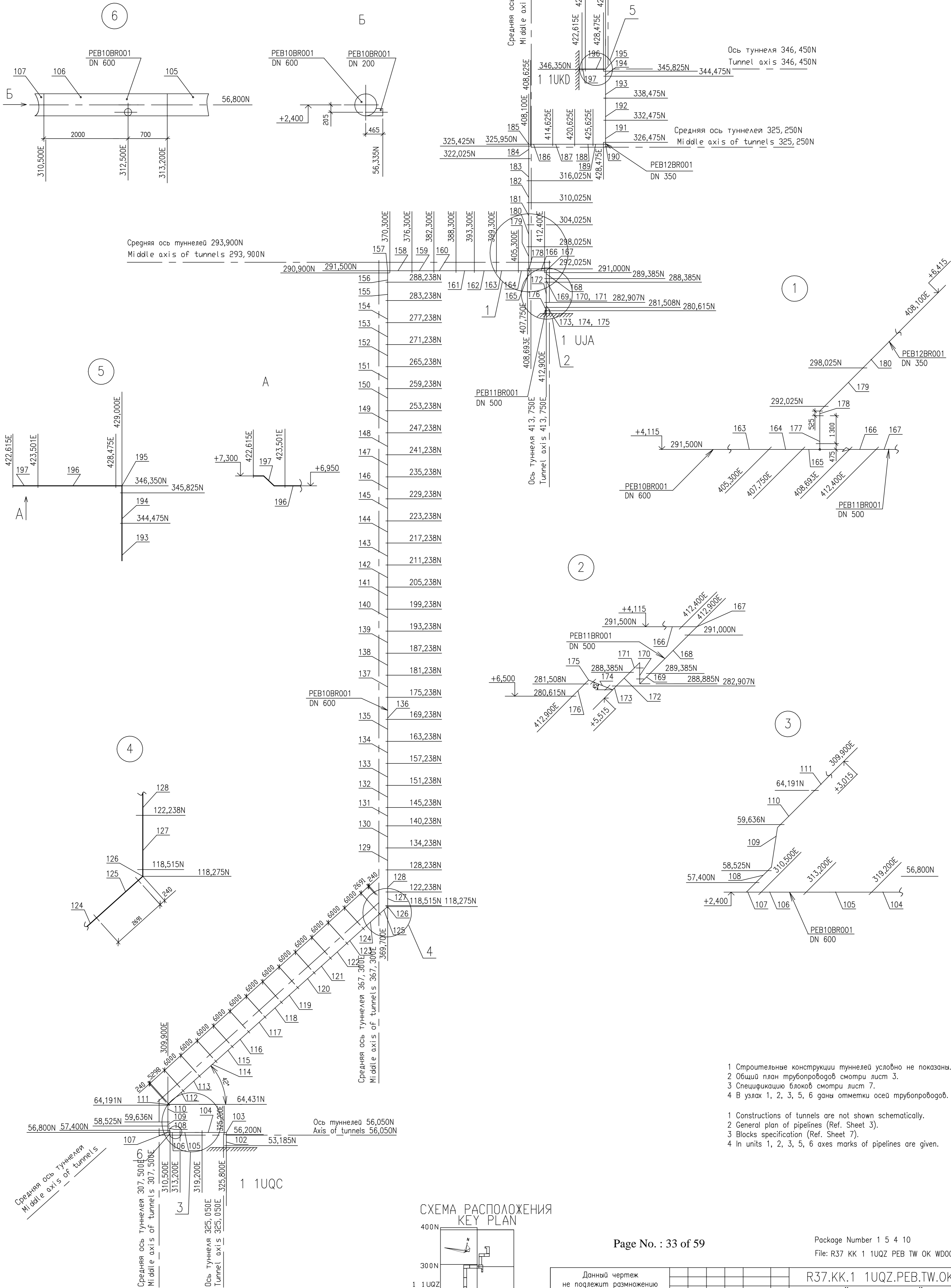
СПЕЦИФИКАЦИЯ БЛОКОВ ТРУБОПРОВОДОВ  
PEB10BR002, PEB11BR002, PEB12BR002

BLOCKS SPECIFICATION OF PIPELINES  
PEB10BR002, PEB11BR002, PEB12BR002

Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q-ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q-ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q-ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q-ty	Масса, ед. кг Unit weight, kg	Примечание Note
73	HC5146.01.00.02 –02	Труба PEB11BR002MR073 Pipe PEB11BR002MR073	1	497,7		43	HC5146.01.00.01 –37	Труба PEB10BR002MR043 Pipe PEB10BR002MR043	1	1113,0		22	HC5146.01.00.01 –17	Труба PEB10BR002MR022 Pipe PEB10BR002MR022	1	1113,0		1	HC5146.01.00.01	Труба PEB10BR002MR001 Pipe PEB10BR002MR001	1	1113,0	
74	HC5146.01.00.06 –01	Отвод PEB11BR002MR074 Pipe-bend PEB11BR002MR074	1	136,9		44	HC5146.01.00.01 –38	Труба PEB10BR002MR044 Pipe PEB10BR002MR044	1	1113,0		23	HC5146.01.00.01 –18	Труба PEB10BR002MR023 Pipe PEB10BR002MR023	1	1113,0		2	HC5146.01.00.01 –01	Труба PEB10BR002MR002 Pipe PEB10BR002MR002	1	1113,0	
75	HC5146.01.00.02 –03	Труба PEB11BR002MR075 Pipe PEB11BR002MR075	1	61,9		45	HC5146.01.00.01 –39	Труба PEB10BR002MR045 Pipe PEB10BR002MR045	1	1113,0		24	HC5146.01.00.01 –19	Труба PEB10BR002MR024 Pipe PEB10BR002MR024	1	1113,0		3	HC5146.01.01.00	Блок PEB10BR002MR003 Block PEB10BR002MR003	1	1132,0	
76	HC5146.01.00.06 –02	Отвод PEB11BR002MR076 Pipe-bend PEB11BR002MR076	1	136,9		46	HC5146.01.00.01 –40	Труба PEB10BR002MR046 Pipe PEB10BR002MR046	1	1113,0		25	HC5146.01.00.01 –20	Труба PEB10BR002MR025 Pipe PEB10BR002MR025	1	1113,0		4	HC5146.01.00.01 –02	Труба PEB10BR002MR004 Pipe PEB10BR002MR004	1	1113,0	
77	HC5146.01.00.02 –04	Труба PEB11BR002MR077 Pipe PEB11BR002MR077	1	928,8		47	HC5146.01.00.01 –41	Труба PEB10BR002MR047 Pipe PEB10BR002MR047	1	1113,0		26	HC5146.01.00.01 –21	Труба PEB10BR002MR026 Pipe PEB10BR002MR026	1	1113,0		5	HC5146.01.00.01 –03	Труба PEB10BR002MR005 Pipe PEB10BR002MR005	1	1113,0	
78	HC5146.01.00.02 –05	Труба PEB11BR002MR078 Pipe PEB11BR002MR078	1	134,7		48	HC5146.01.00.01 –42	Труба PEB10BR002MR048 Pipe PEB10BR002MR048	1	1113,0		27	HC5146.01.00.01 –22	Труба PEB10BR002MR027 Pipe PEB10BR002MR027	1	1113,0		6	HC5146.01.00.01 –04	Труба PEB10BR002MR006 Pipe PEB10BR002MR006	1	1113,0	
79	HC5146.01.00.06 –03	Отвод PEB11BR002MR079 Pipe-bend PEB11BR002MR079	1	136,9		49	HC5146.01.00.01 –43	Труба PEB10BR002MR049 Pipe PEB10BR002MR049	1	1113,0		28	HC5146.01.00.01 –23	Труба PEB10BR002MR028 Pipe PEB10BR002MR028	1	1113,0		7	HC5146.01.00.01 –05	Труба PEB10BR002MR007 Pipe PEB10BR002MR007	1	1113,0	
80	HC5146.01.00.02 –06	Труба PEB11BR002MR080 Pipe PEB11BR002MR080	1	221,5		50	HC5146.01.00.01 –44	Труба PEB10BR002MR050 Pipe PEB10BR002MR050	1	1113,0		29	HC5146.01.00.01 –24	Труба PEB10BR002MR029 Pipe PEB10BR002MR029	1	387,8		8	HC5146.01.00.01 –06	Труба PEB10BR002MR008 Pipe PEB10BR002MR008	1	1113,0	
81	HC5146.01.00.06 –04	Отвод PEB11BR002MR081 Pipe-bend PEB11BR002MR081	1	136,9		51	HC5146.01.00.01 –45	Труба PEB10BR002MR051 Pipe PEB10BR002MR051	1	1113,0		30	HC5146.01.00.05 –01	Отвод PEB10BR002MR030 Pipe-bend PEB10BR002MR030	1	97,8		9	HC5146.01.00.01 –07	Труба PEB10BR002MR009 Pipe PEB10BR002MR009	1	871,8	
82	HC5146.01.00.03	Труба PEB12BR002MR082 Pipe PEB12BR002MR082	1	117,6		52	HC5146.01.00.01 –46	Труба PEB10BR002MR052 Pipe PEB10BR002MR052	1	1113,0		31	HC5146.01.00.01 –25	Труба PEB10BR002MR031 Pipe PEB10BR002MR031	1	577,0		10	HC5146.01.00.04	Отвод PEB10BR002MR010 Pipe-bend PEB10BR002MR010	1	195,5	
83	HC5146.01.00.07	Отвод PEB12BR002MR083 Pipe-bend PEB12BR002MR083	1	93,0		53	HC5146.01.00.01 –47	Труба PEB10BR002MR053 Pipe PEB10BR002MR053	1	1113,0		32	HC5146.01.00.01 –26	Труба PEB10BR002MR032 Pipe PEB10BR002MR032	1	1113,0		11	HC5146.01.00.01 –08	Труба PEB10BR002MR011 Pipe PEB10BR002MR011	1	281,0	
84	HC5146.01.00.03 –01	Труба PEB12BR002MR084 Pipe PEB12BR002MR084	1	443,5		54	HC5146.01.00.01 –48	Труба PEB10BR002MR054 Pipe PEB10BR002MR054	1	1113,0		33	HC5146.01.00.01 –27	Труба PEB10BR002MR033 Pipe PEB10BR002MR033	1	1113,0		12	HC5146.01.00.04 –01	Отвод PEB10BR002MR012 Pipe-bend PEB10BR002MR012	1	195,5	
85	HC5146.01.00.03 –02	Труба PEB12BR002MR085 Pipe PEB12BR002MR085	1	543,1		55	HC5146.01.00.01 –49	Труба PEB10BR002MR055 Pipe PEB10BR002MR055	1	1113,0		34	HC5146.01.00.01 –28	Труба PEB10BR002MR034 Pipe PEB10BR002MR034	1	1113,0		13	HC5146.01.00.01 –09	Труба PEB10BR002MR013 Pipe PEB10BR002MR013	1	927,5	
86	HC5146.01.00.03 –03	Труба PEB12BR002MR086 Pipe PEB12BR002MR086	1	543,1		56	HC5146.01.00.01 –50	Труба PEB10BR002MR056 Pipe PEB10BR002MR056	1	1113,0		35	HC5146.01.00.01 –29	Труба PEB10BR002MR035 Pipe PEB10BR002MR035	1	927,5		14	HC5146.01.00.01 –10	Труба PEB10BR002MR014 Pipe PEB10BR002MR014	1	1039,7	
87	HC5146.01.00.03 –04	Труба PEB12BR002MR087 Pipe PEB12BR002MR087	1	543,1		57	HC5146.01.00.01 –51	Труба PEB10BR002MR057 Pipe PEB10BR002MR057	1	1113,0		36	HC5146.01.00.01 –30	Труба PEB10BR002MR036 Pipe PEB10BR002MR036	1	1113,0		15	HC5146.01.00.05	Отвод PEB10BR002MR015 Pipe-bend PEB10BR002MR015	1	97,8	
88	HC5146.01.00.03 –05	Труба PEB12BR002MR088 Pipe PEB12BR002MR088	1	543,1		58	HC5146.01.00.01 –52	Труба PEB10BR002MR058 Pipe PEB10BR002MR058	1	1113,0		37	HC5146.01.00.01 –31	Труба PEB10BR002MR037 Pipe PEB10BR002MR037	1	1113,0		16	HC5146.01.00.01 –11	Труба PEB10BR002MR016 Pipe PEB10BR002MR016	1	1113,0	
89	HC5146.01.00.03 –06	Труба PEB12BR002MR089 Pipe PEB12BR002MR089	1	452,5		59	HC5146.01.00.01 –53	Труба PEB10BR002MR059 Pipe PEB10BR002MR059	1	927,5		38	HC5146.01.00.01 –32	Труба PEB10BR002MR038 Pipe PEB10BR002MR038	1	1113,0		17	HC5146.01.00.01 –12	Труба PEB10BR002MR017 Pipe PEB10BR002MR017	1	1113,0	
90	HC5146.01.00.07 –01	Отвод PEB12BR002MR090 Pipe-bend PEB12BR002MR090	1	93,0		60	HC5146.01.00.01 –54	Труба PEB10BR002MR060 Pipe PEB10BR002MR060	1	790,6		39	HC5146.01.00.01 –33	Труба PEB10BR002MR039 Pipe PEB10BR002MR039	1	1113,0		18	HC5146.01.00.01 –13	Труба PEB10BR002MR018 Pipe PEB10BR002MR018	1	1113,0	
91	HC5146.01.00.03 –07	Труба PEB12BR002MR091 Pipe PEB12BR002MR091	1	543,1		61	HC5146.01.00.04 –02	Отвод PEB10BR002MR061 Pipe-bend PEB10BR002MR061	1	195,5		40	HC5146.01.00.01 –34	Труба PEB10BR002MR040 Pipe PEB10BR002MR040	1	1113,0		19	HC5146.01.00.01 –14	Труба PEB10BR002MR019 Pipe PEB10BR002MR019	1	1113,0	
92	HC5146.01.00.03 –08	Труба PEB12BR002MR092 Pipe PEB12BR002MR092	1	543,1		62	HC5146.01.00.01 –55	Труба PEB10BR002MR062 Pipe PEB10BR002MR062	1	1113,0		41	HC5146.01.00.01 –35	Труба PEB10BR002MR041 Pipe PEB10BR002MR041	1	1113,0		20	HC5146.01.00.01 –15	Труба PEB10BR002MR020 Pipe PEB10BR002MR020	1	1113,0	
93	HC5146.01.00.03 –09	Труба PEB12BR002MR093 Pipe PEB12BR002MR093	1	543,1		63	HC5146.01.00.01 –56	Труба PEB10BR002MR063 Pipe PEB10BR002MR063	1	1113,0		42	HC5146.01.00.01 –36	Труба PEB10BR002MR042 Pipe PEB10BR002MR042	1	1113,0		21	HC5146.01.00.01 –16	Труба PEB10BR002MR021 Pipe PEB10BR002MR021	1	1113,0	
94	HC5146.01.00.03 –10	Труба PEB12BR002MR094 Pipe PEB12BR002MR094	1	176,5		64	HC5146.01.00.01 –57	Труба PEB10BR002MR064 Pipe PEB10BR002MR064	1	1113,0		<div>1 Номера позиций данной спецификации соответствуют нумерации блоков на листе 4. 2 В графе "Обозначение" дано обозначение чертежей блоков завода-изготовителя. 3 В графе "Наименование" дано обозначение блоков по KKS.  1 Position numbers of this specification correspond with blocks numeration on Sheet 4. 2 In column "Designation" the description of manufacturing plant drawings of blocks is given. 3 In column "Name" designation of blocks according to KKS is given.</div>											
95	HC5146.01.00.07 –02	Отвод PEB12BR002MR095 Pipe-bend PEB12BR002MR095	1	93,0		65	HC5146.01.00.01 –58	Труба PEB10BR002MR065 Pipe PEB10BR002MR065	1	1113,0													
96	HC5146.01.00.03 –11	Труба PEB12BR002MR096 Pipe PEB12BR002MR096	1	538,5		66	HC5146.01.00.01 –59	Труба PEB10BR002MR066 Pipe PEB10BR002MR066	1	927,5													
97	HC5146.01.00.03 –12	Труба PEB12BR002MR097 Pipe PEB12BR002MR097	1	461,5		67	HC5146.01.00.01 –60	Труба PEB10BR002MR067 Pipe PEB10BR002MR067	1	1113,0													
98	HC5146.01.00.03 –13	Труба PEB12BR002MR098 Pipe PEB12BR002MR098	1	497,7		68	HC5146.01.00.01 –61	Труба PEB10BR002MR068 Pipe PEB10BR002MR068	1	398,8		<div>Page No. : 32 of 59</div> <div>Package Number 1 5 4 10</div> <div>File: R37.KK.1 1UQZ.PEB.TW.OK.WD001_05=1.dwg</div> <div><div><div>Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлгазпропроект"</div><div>This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"</div></div><div><div>Изм. N уч.ЛистN док.ПодписьДата</div><div>Rev. N pat. Sheet Doc. No Signature Date</div><div>Утвержден Approved</div><div>Н. контр. Alfimova</div><div>Разработ. Kravchenko</div></div><div><div>1 1UQZ Металлические конструкции трубопроводов ответственных потребителей</div><div>1 1UQZ Metalwork Pipelines of essential services</div><div>Спецификация блоков трубопроводов PEB10BR002, PEB11BR002, PEB12BR002 Blocks specification of pipelines PEB10BR002, PEB11BR002, PEB12BR002</div></div><div><div>Статус Лист Листов</div><div>Phase Sheet Sheets</div><div>5</div><div>Joint-stock Company "Institute Hydroproject" Dnestrovsk 2004</div></div></div>											
99	HC5146.01.00.07 –03	Отвод PEB12BR002MR099 Pipe-bend PEB12BR002MR099	1	93,0		69	HC5146.01.02.00	Блок PEB10BR002MR069 Block PEB10BR002MR069	1	232,0													
100	HC5146.01.00.03 –14	Труба PEB12BR002MR100 Pipe PEB12BR002MR100	1	269,2		70	HC5146.01.00.02	Труба PEB11BR002MR070 Pipe PEB11BR002MR070	1	928,8													
101	HC5146.01.03.00	Блок PEB12BR002MR101 Block PEB12BR002MR101	1	88,8		71	HC5146.01.00.02 –01	Труба PEB11BR002MR071 Pipe PEB11BR002MR071	1	225,5		<div>Формат A1</div>											
						72	HC5146.01.00.06	Отвод PEB11BR002MR072 Pipe-bend PEB11BR002MR072	1	136,9													

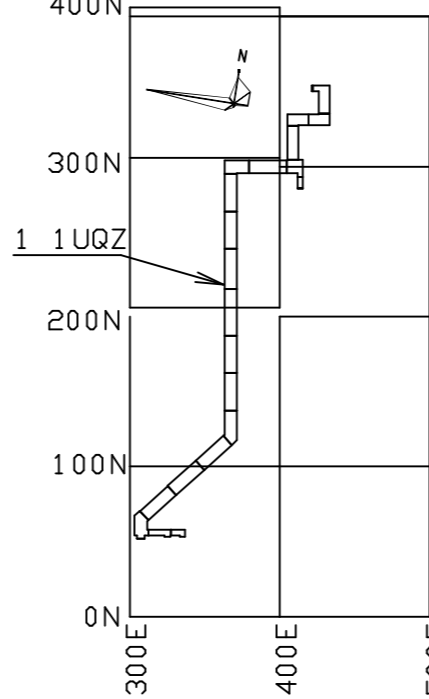


ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ РЕВ10ВR001, РЕВ11ВR001, РЕВ12ВR001 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES РЕВ10ВR001, РЕВ11ВR001, РЕВ12ВR001



- 1 Строительные конструкции туннелей условно не показаны.  
2 Общий план трубопроводов смотри лист 3.  
3 Спецификацию блоков смотри лист 7.  
4 В узлах 1, 2, 3, 5, 6 даны отметки осей трубопроводов.
- 1 Constructions of tunnels are not shown schematically.  
2 General plan of pipelines (Ref. Sheet 3).  
3 Blocks specification (Ref. Sheet 7).  
4 In units 1, 2, 3, 5, 6 axes marks of pipelines are given.

СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



Page No. : 33 of 59

Package Number 1 5 4 10  
File: R37.KK.1 1UQZ.PEB.TW.OK.WD001\_06=1.dwg

Dr'g.	arch.	Nr.	Date	Replace arch.	Nr.
2613			15.03.2004	655	

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This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"						АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT 1		
Изм.	N	уч.	Лист	N	док.	Получить	Дата	1 1UQZ Металлические конструкции трубопроводов ответственных потребителей
Rev.	N	pat.	Sheet	Doc.	No	Signature	Date	1 1UQZ Metalwork Pipelines of essential services
Утвердил	Ymbergul	Approved	Kondratyev					
Н. контр.	Alfimova	Inspector						
Разработ.	Kravchenko	Designed						
План разбивки трубопроводов РЕВ10ВR001, РЕВ11ВR001, РЕВ12ВR001 на блоки Block division plan of pipelines РЕВ10ВR001, РЕВ11ВR001, РЕВ12ВR001						Статус	Лист	Листов
						Phase	Sheet	Sheets
						WD	6	
						Joint-stock Company "Institute Hydroproject" Дедовск 2004		
						Формат А1		

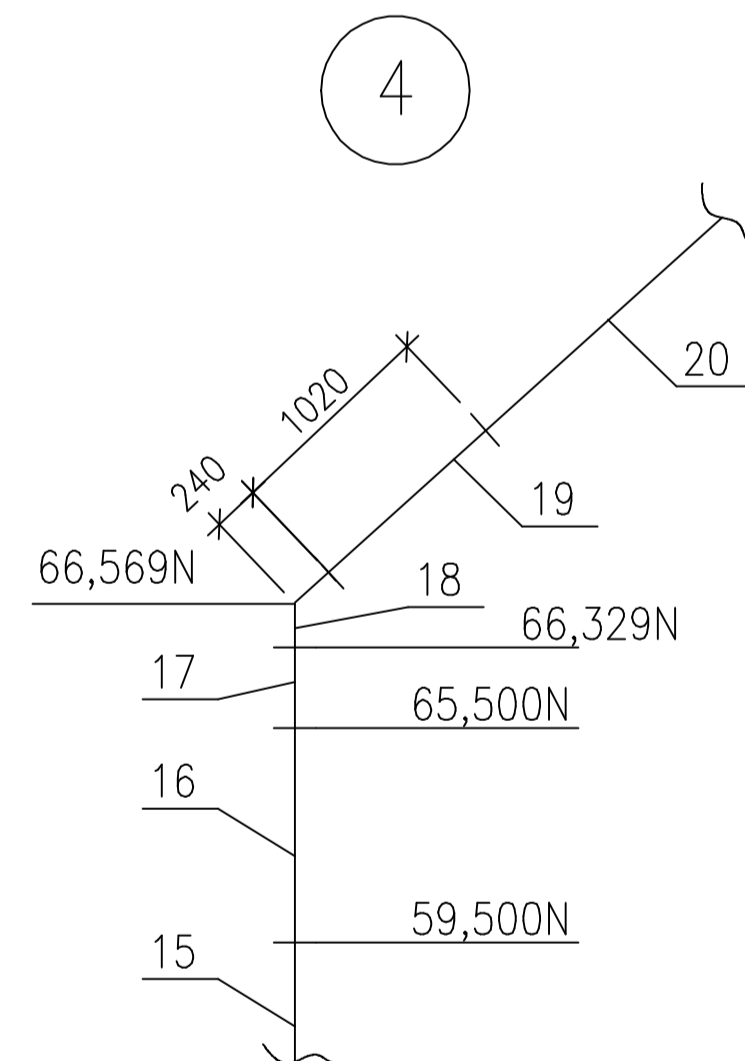
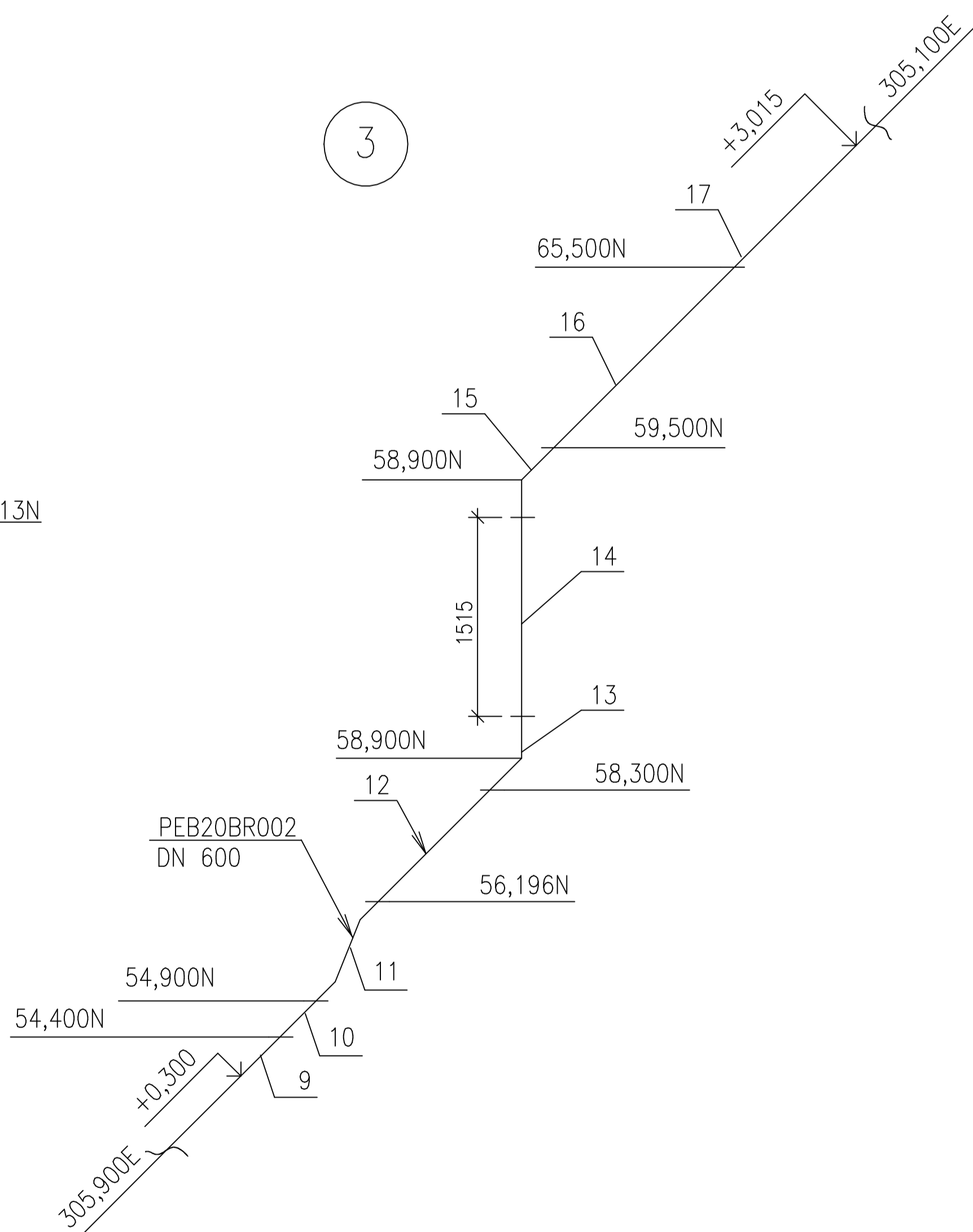
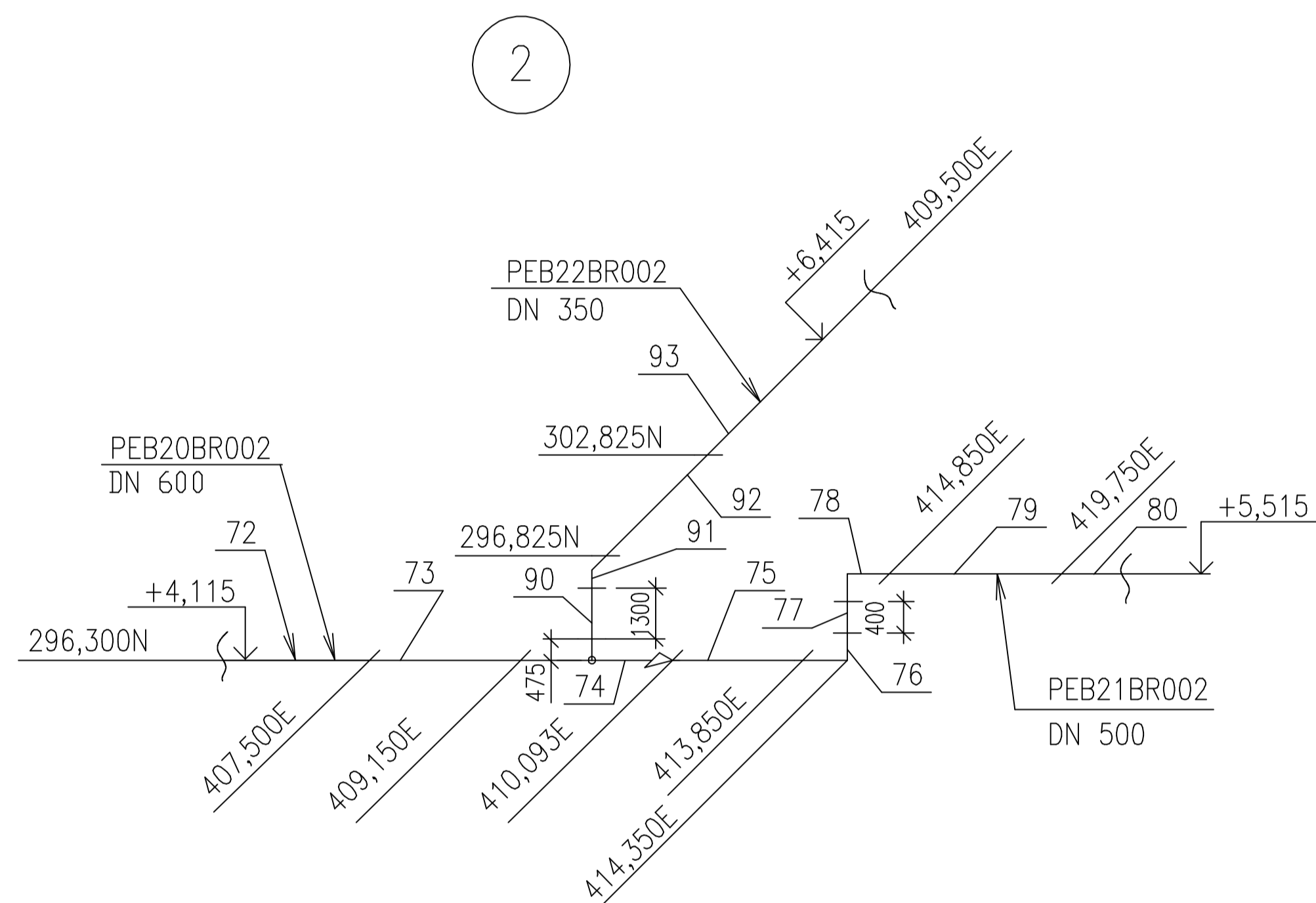
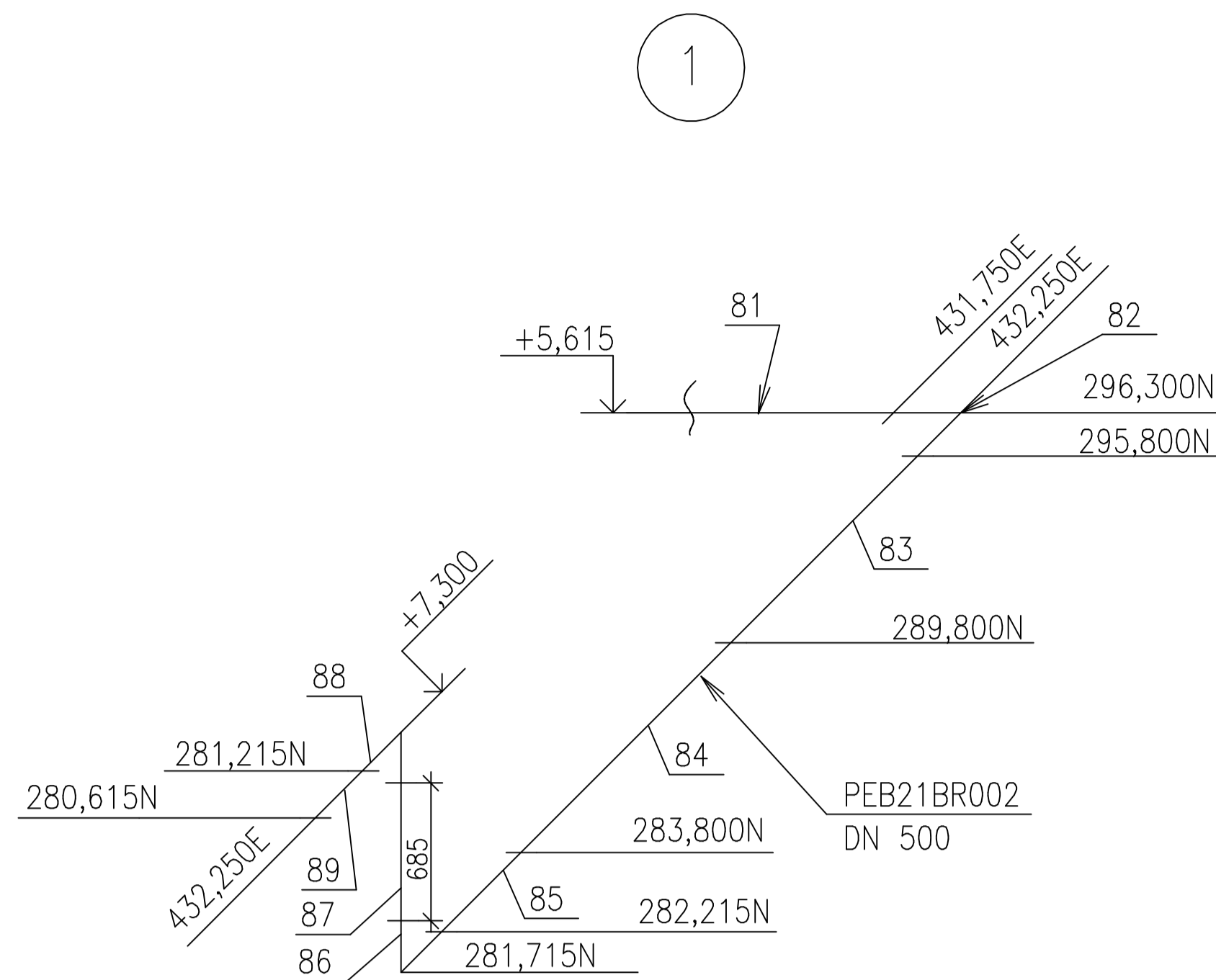
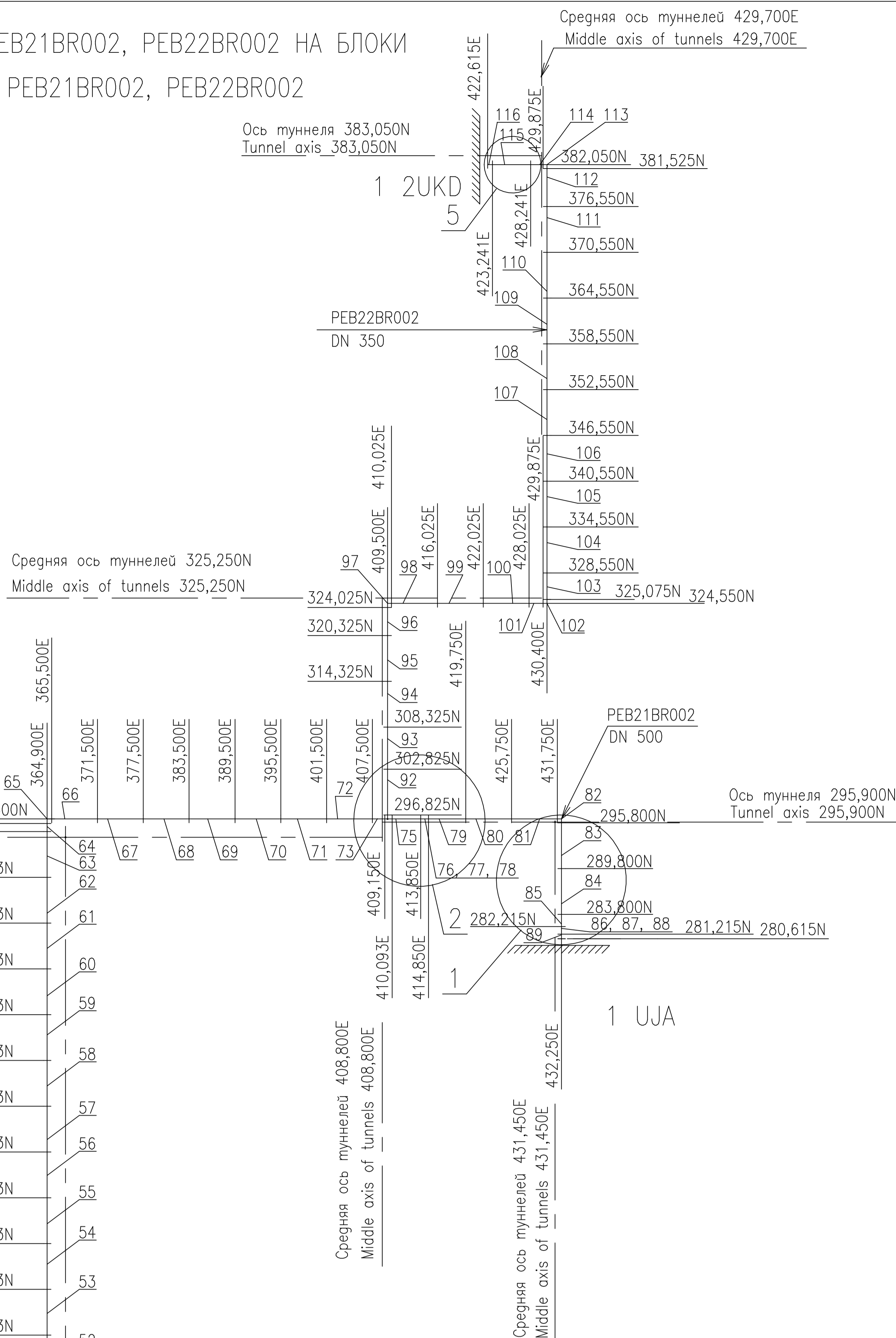
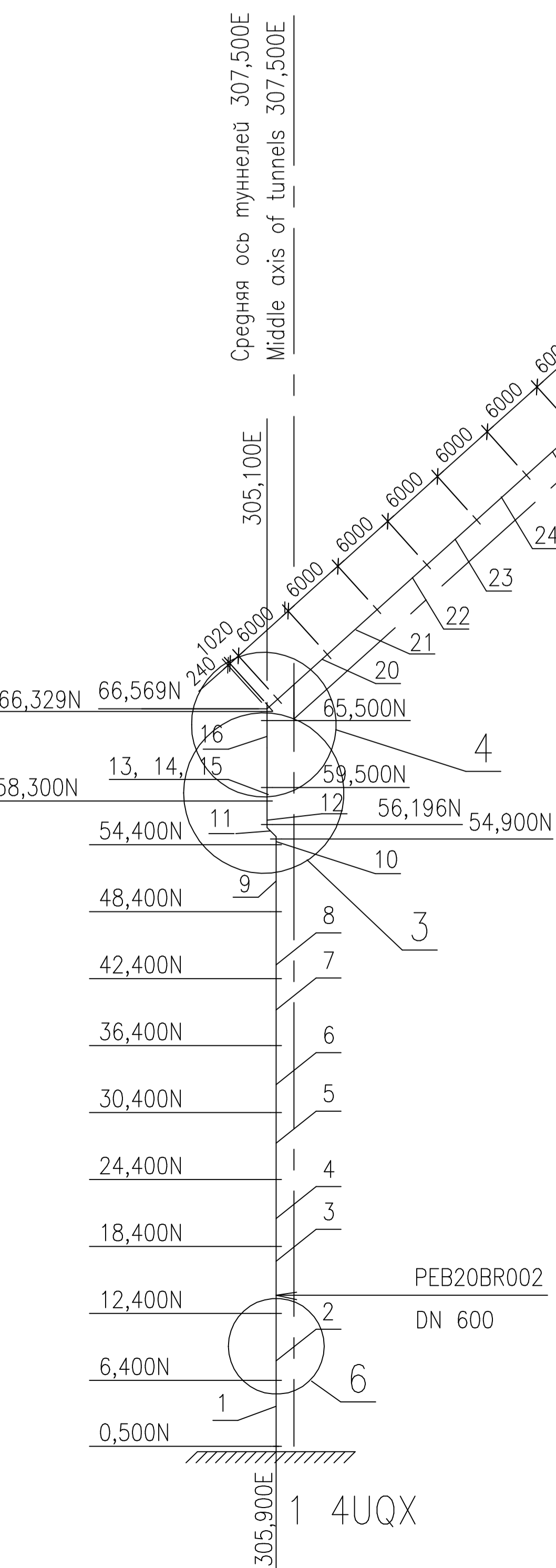
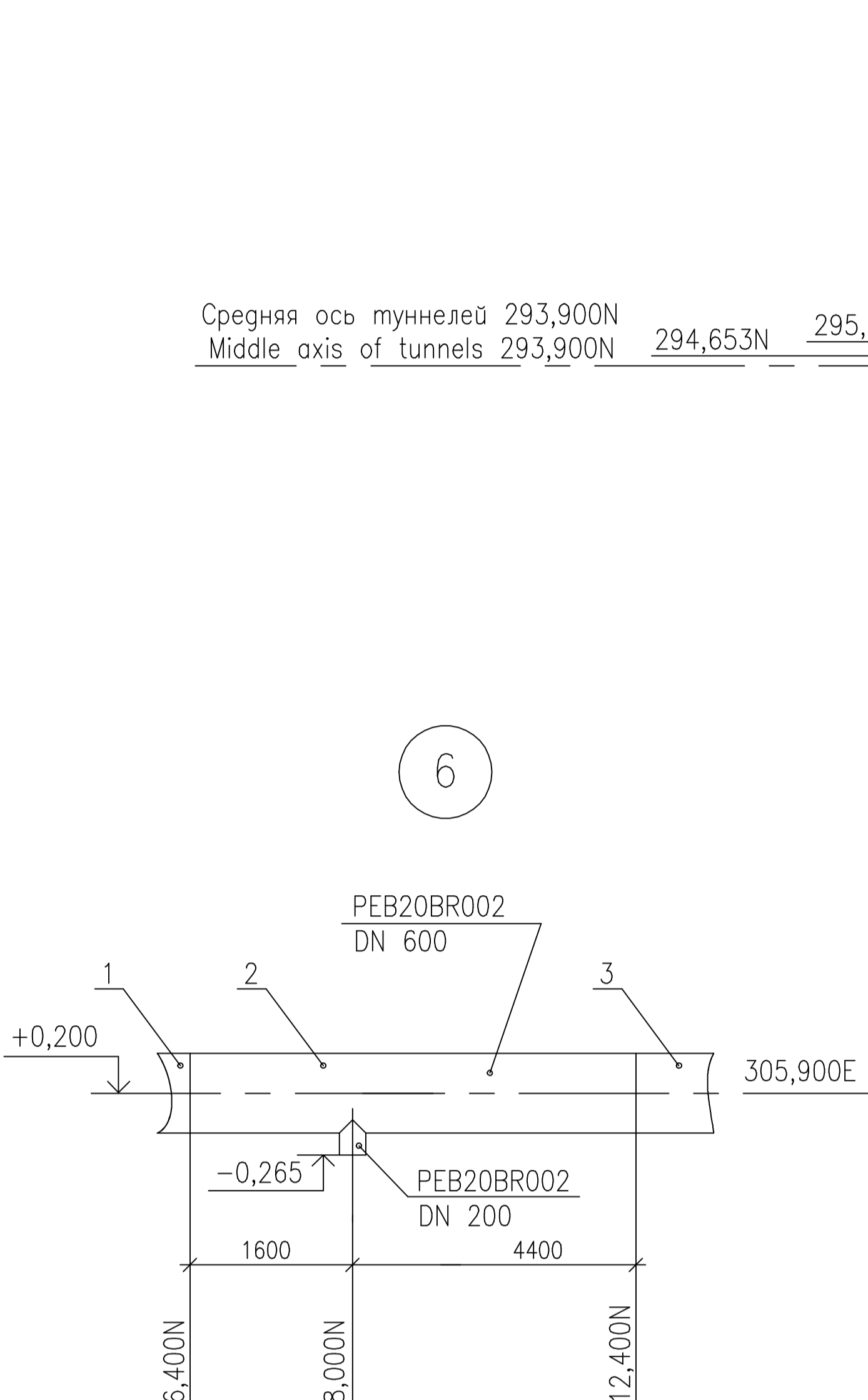
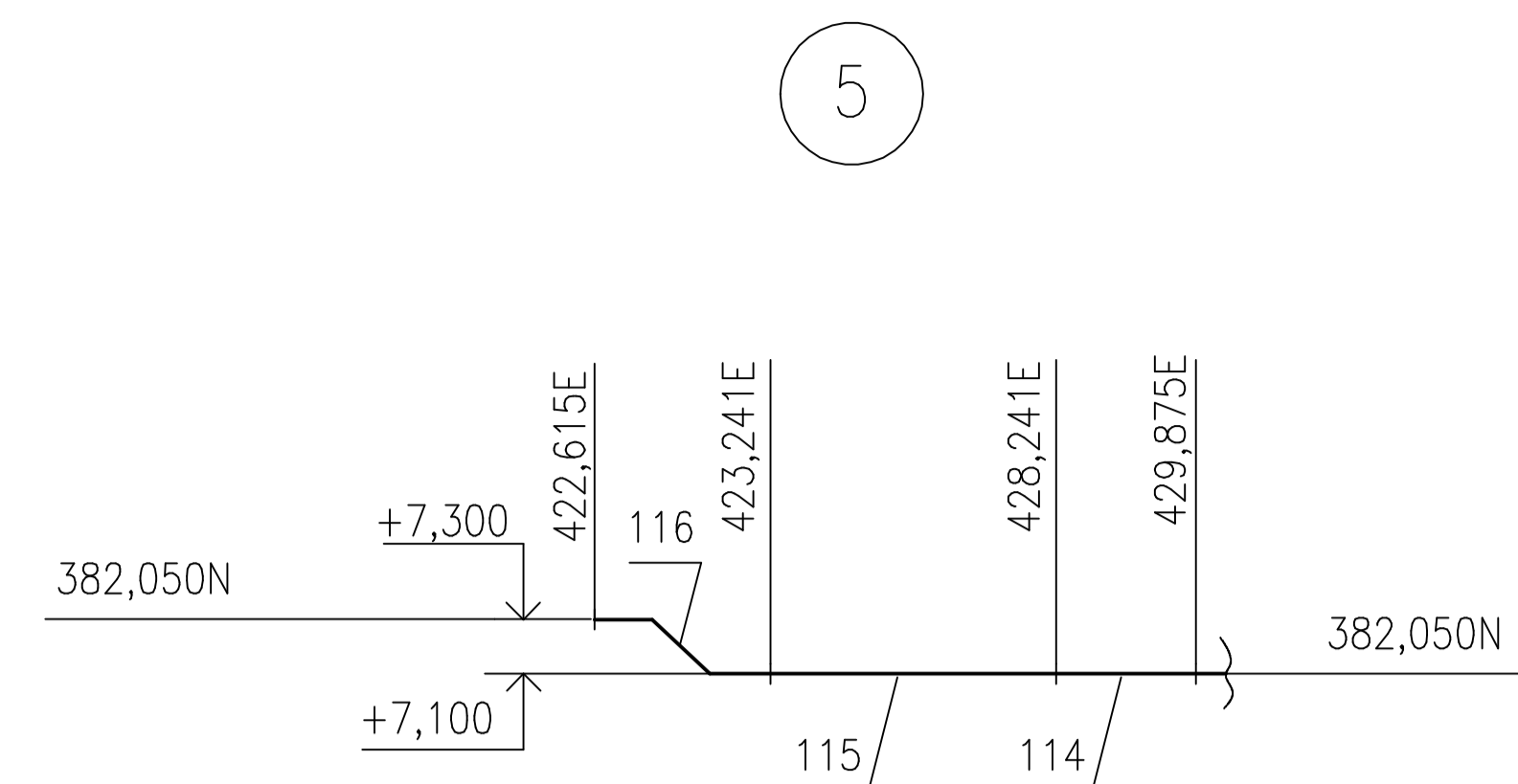
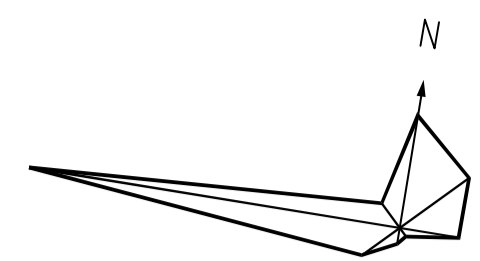
СПЕЦИФИКАЦИЯ БЛОКОВ ТРУБОПРОВОДОВ  
PEB10BR001, PEB11BR001, PEB12BR001

BLOCKS SPECIFICATION OF PIPELINES  
PEB10BR001, PEB11BR001, PEB12BR001

Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. кг Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. кг Unit weight, kg	Примечание Note
171	HC5146.01.00.06 —07	Отвод PEB11BR001MR171 Pipe—bend PEB11BR001MR171	1	136,9		144	HC5146.01.00.01 —98	Труба PEB10BR001MR144 Pipe PEB10BR001MR144	1	1113,0		123	HC5146.01.00.01 —78	Труба PEB10BR001MR123 Pipe PEB10BR001MR123	1	1113,0		102	HC5146.01.00.01 —62	Труба PEB10BR001MR102 Pipe PEB10BR001MR102	1	559,3	
172	HC5146.01.00.02 —10	Труба PEB11BR001MR172 Pipe PEB11BR001MR172	1	878,9		145	HC5146.01.00.01 —99	Труба PEB10BR001MR145 Pipe PEB10BR001MR145	1	1113,0		124	HC5146.01.00.01 —79	Труба PEB10BR001MR124 Pipe PEB10BR001MR124	1	1113,0		103	HC5146.01.00.04 —03	Отвод PEB10BR001MR103 Pipe—bend PEB10BR001MR103	1	195,5	
173	HC5146.01.00.08	Отвод PEB11BR001MR173 Pipe—bend PEB11BR001MR173	1	65,0		146	HC5146.01.00.01 —100	Труба PEB10BR001MR146 Pipe PEB10BR001MR146	1	1113,0		125	HC5146.01.00.01 —80	Труба PEB10BR001MR125 Pipe PEB10BR001MR125	1	499,3		104	HC5146.01.00.01 —63	Труба PEB10BR001MR104 Pipe PEB10BR001MR104	1	1113,0	
174	HC5146.01.00.02 —11	Труба PEB11BR001MR174 Pipe PEB11BR001MR174	1	129,7		147	HC5146.01.00.01 —101	Труба PEB10BR001MR147 Pipe PEB10BR001MR147	1	1113,0		126	HC5146.01.00.05 —03	Отвод PEB10BR001MR126 Pipe—bend PEB10BR001MR126	1	97,8		105	HC5146.01.00.01 —64	Труба PEB10BR001MR105 Pipe PEB10BR001MR105	1	1113,0	
175	HC5146.01.00.08 —01	Отвод PEB11BR001MR175 Pipe—bend PEB11BR001MR175	1	65,0		148	HC5146.01.00.01 —102	Труба PEB10BR001MR148 Pipe PEB10BR001MR148	1	1113,0		127	HC5146.01.00.01 —81	Труба PEB10BR001MR127 Pipe PEB10BR001MR127	1	709,3		106	HC5146.01.04.00	Блок PEB10BR001MR106 Block PEB10BR001MR106	1	528,0	
176	HC5146.01.00.02 —12	Труба PEB11BR001MR176 Pipe PEB11BR001MR176	1	138,2		149	HC5146.01.00.01 —103	Труба PEB10BR001MR149 Pipe PEB10BR001MR149	1	1113,0		128	HC5146.01.00.01 —82	Труба PEB10BR001MR128 Pipe PEB10BR001MR128	1	1113,0		107	HC5146.01.00.04 —04	Отвод PEB10BR001MR107 Pipe—bend PEB10BR001MR107	1	195,5	
177	HC5146.01.00.03 —15	Труба PEB12BR001MR177 Pipe PEB12BR001MR177	1	117,6		150	HC5146.01.00.01 —104	Труба PEB10BR001MR150 Pipe PEB10BR001MR150	1	1113,0		129	HC5146.01.00.01 —83	Труба PEB10BR001MR129 Pipe PEB10BR001MR129	1	1113,0		108	HC5146.01.00.01 —65	Труба PEB10BR001MR108 Pipe PEB10BR001MR108	1	208,7	
178	HC5146.01.00.07 —04	Отвод PEB12BR001MR178 Pipe—bend PEB12BR001MR178	1	93,0		151	HC5146.01.00.01 —105	Труба PEB10BR001MR151 Pipe PEB10BR001MR151	1	1113,0		130	HC5146.01.00.01 —84	Труба PEB10BR001MR130 Pipe PEB10BR001MR130	1	1113,0		109	HC5146.01.05.00	Блок PEB10BR001MR109 Block PEB10BR001MR109	1	267,6	
179	HC5146.01.00.03 —16	Труба PEB12BR001MR179 Pipe PEB12BR001MR179	1	543,1		152	HC5146.01.00.01 —106	Труба PEB10BR001MR152 Pipe PEB10BR001MR152	1	1113,0		131	HC5146.01.00.01 —85	Труба PEB10BR001MR131 Pipe PEB10BR001MR131	1	927,5		110	HC5146.01.00.01 —66	Труба PEB10BR001MR110 Pipe PEB10BR001MR110	1	845,0	
180	HC5146.01.00.03 —17	Труба PEB12BR001MR180 Pipe PEB12BR001MR180	1	543,1		153	HC5146.01.00.01 —107	Труба PEB10BR001MR153 Pipe PEB10BR001MR153	1	1113,0		132	HC5146.01.00.01 —86	Труба PEB10BR001MR132 Pipe PEB10BR001MR132	1	1113,0		111	HC5146.01.00.05 —02	Отвод PEB10BR001MR111 Pipe—bend PEB10BR001MR111	1	97,8	
181	HC5146.01.00.03 —18	Труба PEB12BR001MR181 Pipe PEB12BR001MR181	1	543,1		154	HC5146.01.00.01 —108	Труба PEB10BR001MR154 Pipe PEB10BR001MR154	1	1113,0		133	HC5146.01.00.01 —87	Труба PEB10BR001MR133 Pipe PEB10BR001MR133	1	1113,0		112	HC5146.01.00.01 —67	Труба PEB10BR001MR112 Pipe PEB10BR001MR112	1	1001,5	
182	HC5146.01.00.03 —19	Труба PEB12BR001MR182 Pipe PEB12BR001MR182	1	543,1		155	HC5146.01.00.01 —109	Труба PEB10BR001MR155 Pipe PEB10BR001MR155	1	927,5		134	HC5146.01.00.01 —88	Труба PEB10BR001MR134 Pipe PEB10BR001MR134	1	1113,0		113	HC5146.01.00.01 —68	Труба PEB10BR001MR113 Pipe PEB10BR001MR113	1	1113,0	
183	HC5146.01.00.03 —20	Труба PEB12BR001MR183 Pipe PEB12BR001MR183	1	543,1		156	HC5146.01.00.01 —110	Труба PEB10BR001MR156 Pipe PEB10BR001MR156	1	493,8		135	HC5146.01.00.01 —89	Труба PEB10BR001MR135 Pipe PEB10BR001MR135	1	1113,0		114	HC5146.01.00.01 —69	Труба PEB10BR001MR114 Pipe PEB10BR001MR114	1	1113,0	
184	HC5146.01.00.03 —21	Труба PEB12BR001MR184 Pipe PEB12BR001MR184	1	316,7		157	HC5146.01.00.04 —05	Отвод PEB10BR001MR157 Pipe—bend PEB10BR001MR157	1	195,5		136	HC5146.01.00.01 —90	Труба PEB10BR001MR136 Pipe PEB10BR001MR136	1	1113,0		115	HC5146.01.00.01 —70	Труба PEB10BR001MR115 Pipe PEB10BR001MR115	1	1113,0	
185	HC5146.01.00.07 —05	Отвод PEB12BR001MR185 Pipe—bend PEB12BR001MR185	1	93,0		158	HC5146.01.00.01 —111	Труба PEB10BR001MR158 Pipe PEB10BR001MR158	1	1113,0		137	HC5146.01.00.01 —91	Труба PEB10BR001MR137 Pipe PEB10BR001MR137	1	1113,0		116	HC5146.01.00.01 —71	Труба PEB10BR001MR116 Pipe PEB10BR001MR116	1	1113,0	
186	HC5146.01.00.03 —22	Труба PEB12BR001MR186 Pipe PEB12BR001MR186	1	543,1		159	HC5146.01.00.01 —112	Труба PEB10BR001MR159 Pipe PEB10BR001MR159	1	1113,0		138	HC5146.01.00.01 —92	Труба PEB10BR001MR138 Pipe PEB10BR001MR138	1	1113,0		117	HC5146.01.00.01 —72	Труба PEB10BR001MR117 Pipe PEB10BR001MR117	1	1113,0	
187	HC5146.01.00.03 —23	Труба PEB12BR001MR187 Pipe PEB12BR001MR187	1	543,1		160	HC5146.01.00.01 —113	Труба PEB10BR001MR160 Pipe PEB10BR001MR160	1	1113,0		139	HC5146.01.00.01 —93	Труба PEB10BR001MR139 Pipe PEB10BR001MR139	1	1113,0		118	HC5146.01.00.01 —73	Труба PEB10BR001MR118 Pipe PEB10BR001MR118	1	1113,0	
188	HC5146.01.00.03 —24	Труба PEB12BR001MR188 Pipe PEB12BR001MR188	1	452,5		161	HC5146.01.00.01 —114	Труба PEB10BR001MR161 Pipe PEB10BR001MR161	1	927,5		140	HC5146.01.00.01 —94	Труба PEB10BR001MR140 Pipe PEB10BR001MR140	1	1113,0		119	HC5146.01.00.01 —74	Труба PEB10BR001MR119 Pipe PEB10BR001MR119	1	1113,0	
189	HC5146.01.00.03 —25	Труба PEB12BR001MR189 Pipe PEB12BR001MR189	1	267,0		162	HC5146.01.00.01 —115	Труба PEB10BR001MR162 Pipe PEB10BR001MR162	1	1113,0		141	HC5146.01.00.01 —95	Труба PEB10BR001MR141 Pipe PEB10BR001MR141	1	1113,0		120	HC5146.01.00.01 —75	Труба PEB10BR001MR120 Pipe PEB10BR001MR120	1	1113,0	
190	HC5146.01.00.07 —06	Отвод PEB12BR001MR190 Pipe—bend PEB12BR001MR190	1	93,0		163	HC5146.01.00.01 —116	Труба PEB10BR001MR163 Pipe PEB10BR001MR163	1	1113,0		142	HC5146.01.00.01 —96	Труба PEB10BR001MR142 Pipe PEB10BR001MR142	1	1113,0		121	HC5146.01.00.01 —76	Труба PEB10BR001MR121 Pipe PEB10BR001MR121	1	1113,0	
191	HC5146.01.00.03 —26	Труба PEB12BR001MR191 Pipe PEB12BR001MR191	1	543,1		164	HC5146.01.00.01 —117	Труба PEB10BR001MR164 Pipe PEB10BR001MR164	1	473,0		143	HC5146.01.00.01 —97	Труба PEB10BR001MR143 Pipe PEB10BR001MR143	1	1113,0		122	HC5146.01.00.01 —77	Труба PEB10BR001MR122 Pipe PEB10BR001MR122	1	1113,0	
192	HC5146.01.00.03 —27	Труба PEB12BR001MR192 Pipe PEB12BR001MR192	1	543,1		165	HC5146.01.06.00	Блок PEB10BR001MR165 Block PEB10BR001MR165	1	232,0		<div>1 Номера позиций данной спецификации соответствуют нумерации блоков на листе 6. 2 В графе "Обозначение" дано обозначение чертежей блоков завода-изготовителя. 3 В графе "Наименование" дано обозначение блоков по KKS.</div> <div>1 Position numbers of this specification correspond with blocks numeration on Sheet 6. 2 In column "Designation" the description of manufacturing plant drawings of blocks is given. 3 In column "Name" designation of blocks according to KKS is given.</div>											
193	HC5146.01.00.03 —28	Труба PEB12BR001MR193 Pipe PEB12BR001MR193	1	543,1		166	HC5146.01.00.02 —07	Труба PEB11BR001MR166 Pipe PEB11BR001MR166	1	573,8													
194	HC5146.01.00.03 —29	Труба PEB12BR001MR194 Pipe PEB12BR001MR194	1	131,2		167	HC5146.01.00.06 —05	Отвод PEB11BR001MR167 Pipe—bend PEB11BR001MR167	1	136,9													
195	HC5146.01.00.07 —07	Отвод PEB12BR001MR195 Pipe—bend PEB12BR001MR195	1	93,0		168	HC5146.01.00.02 —08	Труба PEB11BR001MR168 Pipe PEB11BR001MR168	1	250,0													
196	HC5146.01.00.03 —30	Труба PEB12BR001MR196 Pipe PEB12BR001MR196	1	450,2		169	HC5146.01.00.06 —06	Отвод PEB11BR001MR169 Pipe—bend PEB11BR001MR169	1	136,9		<div>1 1UQZ Metalwork Pipelines of essential service</div> <div>1 1UQZ Metalwork Pipelines of essential service</div>											
197	HC5146.01.07.00	Блок PEB12BR001MR197 Block PEB12BR001MR197	1	88,8		170	HC5146.01.00.02 —09	Труба PEB11BR001MR170 Pipe PEB11BR001MR170	1	61,9													

Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлгидропроект"  This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"								R37.KK.1_1UQZ.PEB.TW.OK.WD001				
								АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT				
	1	—	Repl.	1—04								
	Изм.	N	уч.	Лист	N	док.	Подпись	Дата	1 1UQZ Металлические конструкции трубопроводов ответственных потребителей	Стадия	Лист	Листов
	Rev.	N	pat.	Sheet		Doc.	Signature	Date		Phase	Sheet	Sheets
	Утвердил								1 1UQZ Metalwork Pipelines of essential service	WB	7	
	Инспектор								Спецификация блоков трубопроводов PEB10BR001, PEB11BR001, PEB12BR001 Blocks specification of pipelines PEB10BR001, PEB11BR001, PEB12BR001	Joint-stock Company "Institute Hydroproject" Dudovsk 2004		
	Разработ.											
	Designed											

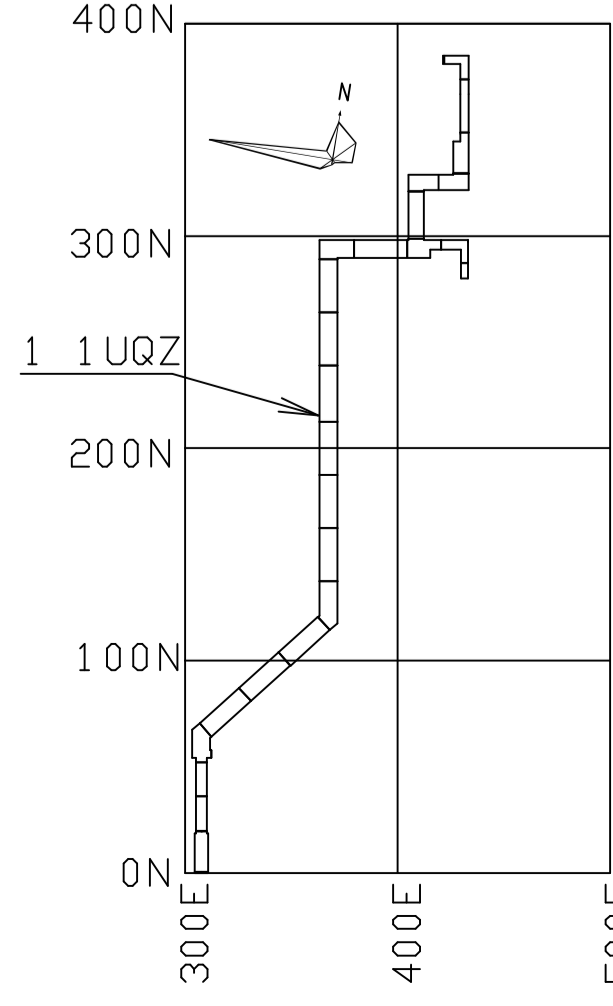
ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ РЕВ20ВR002, РЕВ21ВR002, РЕВ22ВR002 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES РЕВ20ВR002, РЕВ21ВR002, РЕВ22ВR002



- 1 Строительные конструкции туннелей условно не показаны.
- 2 Общий план трубопроводов смотри лист 3.
- 3 Спецификацию блоков трубопроводов смотри лист 9.
- 4 В узлах 1, 2, 3, 5, 6 даны отметки осей трубопроводов.

- 1 Constructions of tunnels are not shown schematically.
- 2 General plan of pipelines (Ref. Sheet 3).
- 3 Blocks specification of pipelines (Ref. Sheet 9).
- 4 In units 1, 2, 3, 5, 6 axes marks of pipelines are given.

СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлиздропроект"						R37.KK.1 1UQZ.PEB.TW.OK.WD001						
						АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1						
	1	—	Repl.	1-04			1 UQZ		Смаглы	Лист	Листов	
	Изм.	N	уч.	Лист	N	погн.	Дато	Металлические конструкции трубопроводов ответственных потребителей		Phase	Sheet	Sheets
	Rev.	N	pat.	Sheet	Doc. No	Signature	Date	1 UQZ		WD	8	
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"	Умбергул							Metalwork Pipelines of essential services				
	Н. комп.							План разбивки трубопроводов PEБ20BR002, PEБ21BR002, PEБ22BR002 на блоки		Joint-stock Company "Institute Hydroproject"		
	Inspector							Block division plan of pipelines PEБ20BR002, PEБ21BR002, PEБ22BR002		Dedovsk 2004		
	Разраб.							H. комп. Alifimova				
	Designed							Krovchenko				

BLOCKS SPECIFICATION OF PIPELINES  
PEB20BR002, PEB21BR002, PEB22BR002

1 Номера позиций данной спецификации соответствуют нумерации блоков на листе 8.  
2 В графе "Обозначение" дано обозначение чертежей блоков завода-изготовителя.  
3 В графе "Наименование" дано обозначение блоков по KKS.

1 Position numbers of this specification correspond with blocks numeration on Sheet 8.  
2 In column "Designation" the description of manufacturing plant drawings of blocks is given.  
3 In column "Name" designation of blocks according to KKS is given.

Формат A2x3



## BLOCKS SPECIFICATION OF PIPELINES

Orig. arch. Nr.	Date	Replace arch. Nr.
2613	15.03.2004	655

ВЕДОМОСТЬ РАБОЧИХ ЧЕРТЕЖЕЙ ОСНОВНОГО КОМПЛЕКТА  
LIST OF THE WORKING DRAWINGS OF MAIN PACKAGE

Лист Sheet	Наименование Description	Примечание Note
1	Общие данные General data	Изм.1 (Зам.) Rev.1 (Repl.)
2	Схема трубопровода Layout of pipelines	Изм.1 (Зам.) Rev.1 (Repl.)
3	План трубопровода Pipelines plan	Изм.1 (Зам.) Rev.1 (Repl.)
4	План разбивки трубопроводов ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001 на блоки Block division plan of pipelines ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001	Изм.1 (Зам.) Rev.1 (Repl.)
5	Спецификация блоков трубопроводов ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001 Blocks specification of pipelines ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001	Изм.1 (Зам.) Rev.1 (Repl.)
6	План разбивки трубопроводов ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002 на блоки Block division plan of pipelines ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002	Изм.1 (Зам.) Rev.1 (Repl.)
7	Спецификация блоков трубопроводов ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002 Blocks specification of pipelines ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002	Изм.1 (Зам.) Rev.1 (Repl.)
8	План разбивки трубопроводов ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001 на блоки Block division plan of pipelines ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001	Изм.1 (Зам.) Rev.1 (Repl.)
9	Спецификация блоков трубопроводов ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001 Blocks specification of pipelines ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001	Изм.1 (Зам.) Rev.1 (Repl.)
10	План разбивки трубопроводов ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002 на блоки Block division plan of pipelines ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002	Изм.1 (Зам.) Rev.1 (Repl.)
11	Спецификация блоков трубопроводов ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002 Blocks specification of pipelines ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002	Изм.1 (Зам.) Rev.1 (Repl.)
12	План расстановки опор на трубопроводах ПЕВ30, ПЕВ31, ПЕВ32 Layout of supports on the pipelines ПЕВ30, ПЕВ31, ПЕВ32	Изм.1 (Зам.) Rev.1 (Repl.)
13	Ведомость опор трубопроводов ПЕВ30, ПЕВ31, ПЕВ32 List of supports of pipelines ПЕВ30, ПЕВ31, ПЕВ32	Изм.1 (Нов.) Rev.1 (New)
14	План расстановки опор на трубопроводах ПЕВ40, ПЕВ41, ПЕВ42 Layout of supports on the pipelines ПЕВ40, ПЕВ41, ПЕВ42	Изм.1 (Нов.) Rev.1 (New)
15	Ведомость опор трубопроводов ПЕВ40, ПЕВ41, ПЕВ42 List of supports of pipelines ПЕВ40, ПЕВ41, ПЕВ42	Изм.1 (Нов.) Rev.1 (New)
16	Установка скользящих, направляющих и неподвижных опор трубопроводов Installation of sliding, guide and fixed supports of pipelines	Изм.1 (Нов.) Rev.1 (New)

ВЕДОМОСТЬ ОСНОВНЫХ КОМПЛЕКТОВ РАБОЧИХ ЧЕРТЕЖЕЙ  
LIST OF MAIN PACKAGES CONSISTING OF THE WORKING DRAWINGS

Обозначение Designation	Наименование Description	Примечание Note
R37.KK.1.2UOZ.PEB.TW.OK.WD Изменение 1	Металлические конструкции трубопроводов ответственных потребителей	Пакет № 1 5 4 10
R37.KK.1.2UOZ.PEB.TW.OK.WD Amendment Number 1	Metalwork Pipelines of essential services	Package Number 1 5 4 10
R37.KK.1.2UOZ.PEB.KZ.OK.WD	Блопороды ответственных потребителей. Железобетонные изделия Pipelines of essential services. Reinforced concrete items	Пакет № 1 5 4 10 Package Number 1 5 4 10
R37.KK.1.2UOZ.PIUQ.TW.OK.WD Изменение 1	Система дренажа сбросных вод. Дренаж вод из туннелей в случае разрыва трубопровода	Пакет № 1 6 4 11
R37.KK.1.2UOZ.PIUQ.TW.OK.WD Amendment Number 1	Drain water removal system. Water removal from tunnels in case of pipeline break	Package Number 1 6 4 11

ВЕДОМОСТЬ СПЕЦИФИКАЦИЙ  
SPECIFICATION LIST

Лист Sheet	Наименование Description	Примечание Note
5	Спецификация блоков трубопроводов ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001 Specification for blocks of pipelines ПЕВ30БР001, ПЕВ31БР001, ПЕВ32БР001	Изм.1 (Зам.) Rev.1 (Repl.)
7	Спецификация блоков трубопроводов ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002 Specification for blocks of pipelines ПЕВ30БР002, ПЕВ31БР002, ПЕВ32БР002	Изм.1 (Зам.) Rev.1 (Repl.)
9	Спецификация блоков трубопроводов ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001 Specification for blocks of pipelines ПЕВ40БР001, ПЕВ41БР001, ПЕВ42БР001	Изм.1 (Зам.) Rev.1 (Repl.)
11	Спецификация блоков трубопроводов ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002 Specification for blocks of pipelines ПЕВ40БР002, ПЕВ41БР002, ПЕВ42БР002	Изм.1 (Зам.) Rev.1 (Repl.)

ТЕХНИЧЕСКАЯ ХАРАКТЕРИСТИКА И СВОДКА МАСС ТРУБОПРОВОДОВ  
PERFORMANCE AND WEIGHT DATA OF PIPELINES

Позволение на прокладку трубопровода	Наименование транспортируемого продукта	Подлежащая вещность	Рабочие условия трубопровода		Условия газоснастанный		Диаметр и толщина стенки трубопровода, мм	Масса трубопроводов, кг						
			Давление, МПа	Температура, °C	Давление, МПа	Минимальная температура стенки, °C		В том числе						
								Общая	Трубо – провода	Опор				
Pipeline designation	Description of transported matter	Subject to	Pipeline operating conditions		Hydraulic test conditions		Pipeline weight, kg							
			Pressure, MPa	Temperature, °C	Pressure, MPa	Minimum temperature of pipe wall, °C	Total	Pipeline weight	Support weight					
PEB30	Морская вода Sea water	ПНАЗ 1-7-4008-89 PNAZ 1-7-4008-89	0,6	34	1,0	19	630x12	250942,4	240694,5	10247,9				
PEB40				39							530x12	49570,8	47855,8	1715,0
PEB31				39										
PEB41				39										
PEB32				34			377x10	29039,8	28254,9	784,0				
PEB42				39										

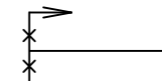

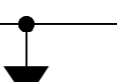


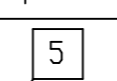
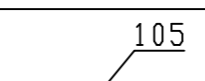


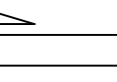
МЕТОДЫ И ОБЪЕМЫ КОНТРОЛЯ СВАРНЫХ СОЕДИНЕНИЙ  
METHODS AND DEGREE OF INSPECTION OF WELDED JOINTS

Номер трубопровода Pipeline number	Классификация сварного соединения или категории сварного шва Category of weld joints or category of weld	Объем контроля Degree of inspection	Объем контроля Degree of inspection										
			Визуального и измерительного Visual and measuring inspection		Неразрушающего, % Non-destructive, %				Разрушающего Destructive				
			Визуальное Visual	Измерительное Measuring	Гидравлические испытания Hydraulic test	Капиллярного или магнитопорошкового Capillary or magnetic particle inspection	Радиационного Radiographic inspection	Ультразвукового Ultrasonic inspection	Прогиб металламином Roll in the metal pass	Контроль герметичности Leakproofness test	Определение механических свойств Determination of stress-strain properties	Металлографическое исследование Metallographic examination	Испытания на стойкость к межкристаллитной коррозии Inter-crystalline corrosion process test
PEB30	II	12, 9	100	100	50	50	100	-	-	-	-	-	-
PEB40													
PEB31													
PEB41													
PEB32													
PEB42	100	100	50	50	100	-	-	-	-	-	-	-	

ХИМИЧЕСКИЙ СОСТАВ МОРСКОЙ ВОДЫ  
CHEMICAL COMPOSITION OF SEA WATER

Название Element	Величина Value	Примечание Note
1 Кальция, мг/л Calcium, mg/l	360...420	
2 Магния, мг/л Magnesium, mg/l	1248...1322	
3 Натрия, мг/л Sodium, mg/l	7500...8500	
4 Калия, мг/л Potassium, mg/l	390...415	
5 Гидрокарбонаты, мг/л Hydrocarbonates, mg/l	73,2...109,8	
6 Карбонаты, мг/л Carbonates, mg/l	67,2...76,8	
7 Сульфаты, мг/л Sulphates, mg/l	2709...2761	
8 Хлориды, мг/л Chlorides, mg/l	19500	
9 Общее содержание, % General salt content, %	3,6	
10 Жесткость (CaCl <sub>2</sub> ), мг/л Water hardness, mg/l	6500	
11 Водородный показатель pH pH value	8	
12 Нерастворимые вещества, мг/л Insoluble matters, mg/l	20	
13 Биологические данные, мг/100 м <sup>3</sup> Biological assay mg/100 m <sup>3</sup>	70	

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ  
LEGEND

	Граница проектирования Design boundary
	Переход Adapter
	Спуск воды из трубопровода Water discharge from pipeline
	Соединение трубопроводов Connection of pipelines
	Соединение трубопроводов отсутствует No connection of pipelines
	Порядковый номер опоры Sequence number of support
	Порядковый номер блока трубопровода, монтажный шов Sequence number of pipeline block, erection weld
	Направление движения среды Direction of medium motion
	Направление уклона трубопровода Pipeline pitch direction
	Неподвижная опора N 1 Fixed support Number 1

## ОБЩИЕ УКАЗАНИЯ

1 Настоящий комплект рабочей документации разработан в соответствии с основными решениями, принятыми в техническом проекте и действующих нормах, правилах и стандартах.

2 Классификация трубопроводов:

- 2НО по НП-001-97 (ПНАЗ Г-01-011-97) "Общие положения обеспечения безопасности атомных станций. ОПБ-88/97";
- группа В по ПНАЗ Г-7-008-89 "Правила устройства и безопасной эксплуатации оборудования и трубопроводов атомных энергетических установок";
- категория сейсмостойкости I по ПНАЗ Г-5-006-87 "Нормы проектирования сейсмостойких атомных станций".

3 Расчеты трубопроводов на прочность выполнены в соответствии с ПНАЗ Г-7-002-86 "Нормы расчета на прочность оборудования и трубопроводов атомных энергетических установок".

4 Трубопроводы прокладываются в туннелях 1 2УОЗ с уклоном в сторону слабо бока в силовой колодец 1 3УОХ. Величина уклона трубопроводов определяется величиной уклона дни туннелей и находится в пределах от  $i=0,0035$  до  $i=0,0050$ .

5 Трубопроводы прокладываются на технологических опорах (скользящих и направляющих), которые устанавливаются на опорные железобетонные подушки, (смотри комплект чертежей РЗ.К37.1. 2УОЗ.РЕВ.КЗ.ОД.ВОО03).

6 Компенсация температурных удлинений осуществляется за счет естественных излов поворота трассы трубопроводов.

Весь усадка и моменты, возникающие от сочетания действующих нагрузок (оседей, боковых, весовых), воспринимаются неподвижными опорами.

Опорожнение трубопроводов предусматривается через дренажные узлы, которые устанавливаются в местах трубопроводов со сбросом воды в специально предусмотренные дренажные приемы в туннелях, с последующей перекачкой воды из них в силовой колодец 1 3УОХ.

Диаметр дренажных узлов принят из условия самотечного опорожнения трубопроводов в течение двух часов.

8 Выпуск воздуха из трубопроводов в туннелях 1 2УОЗ не предусматривается.

9 Монтаж трубопроводов осуществляется блоками заводского изготовления на сборке в соответствии с ПНАЗ Г-7-009-89 "Оборудование и трубопроводы атомных энергетических установок. Сварка и наплавка. Основные положения".

Сварные соединения относятся к категории II, подкатегория IIб по ПНАЗ Г-7-010-89 "Оборудование и трубопроводы атомных энергетических установок. Сварные соединения и наплавки. Правила контроля".

Контроль качества сварных соединений по ПНАЗ Г-7-010-89 "Оборудование и трубопроводы атомных энергетических установок. Сварные соединения и наплавки. Правила контроля".

10 Трубопроводы монтируются с обязательным устройством антикоррозионного защитного покрытия внутренней и наружной поверхностей труб от влияния морской воды и кислорода воздуха. Наружная поверхность труб теплоизолируется от возможного появления конденсата на их поверхности.

Данные работы выполняются отдельными проектами и в состав данного комплекта рабочей документации не входят.

11 Строительная часть выполняется по чертежам пакета 1 4 4 12.

\* Внесено изменение 1 в листы 1..16.

## GENERAL GUIDELINES

1 The present working documentation package is developed in accordance with basic decisions accepted in the detail design, as well as in conformity with valid Codes, Standards and Regulations.

2 Pipelines classification:  
- 2ND NP-001-97 (PNAE G-01-011-97) "General Regulations on Nuclear Power Station Protection. OPB-88/97";

3 Pipelines are in compliance with PNAE G-7-008-89 "Regulations on Arrangement and safe operation of equipment and pipelines of nuclear power plants";

4 - seismic stability category I in conformity with PNAE G-5-006-87 "Design Standards for aseismic nuclear power stations".

5 Pipelines strength analysis is implemented in conformity with PNAE G-7-002-86 "Strength analysis Standards for equipment and pipelines of nuclear power plants".

6 Pipelines are to be laid out in tunnels 1 2UQZ with pitch towards water discharge to the siphon pit 1 3UQX.

7 Pipelines gradient is determined by the tunnel floor slope and is positioned within the limits: from  $i=0,0035$  to  $i=0,0050$ .

8 Pipelines are to be laid out using technological supports (sliding and guide supports), that are to be installed on the reinforced bearing blocks, (Ref. Package R37.KK.1 2UQZ.FEB.KZ.KO.WD003).

9 Temperature rolling-out compensation is carried out due to natural turning angle of pipeline route.

10 All the forces and moments that evolved from load combination (axial load, side load, weight bearing load) are reacted by fixed supports.

11 Pipeline emptying is to be executed through drain modules that should be placed in lower points of pipelines and imply water discharge to the special drainage pits and then water transfer to the siphon pit 1 3UQX. Drainage module diameter is determined due to pipeline gravity emptying within two hours.

12 Air discharge from the pipelines in the tunnels 1 2UQZ is not provided.

13 Erection of pipelines is performed by factory made blocks on welding in accordance with PNAE G-7-009-89 "Equipment and pipelines for nuclear power plants. Welding and surfacing. General Regulations".

14 Welded connections subject to category II, subcategory IIb in conformity with PNAE G-7-010-89 "Equipment and pipelines for nuclear power plants. Welding connection and surfacing. Control rules".

15 Welding connections quality inspection is in conformity with PNAE G-7-010-89 "Equipment and pipelines for nuclear power plants. Welding connection and surfacing. Control rules".

16 Pipelines are to be laid using corrosion preventing pipe coating for inside and outer pipe surfaces in order to prevent sea-water and air forcing.

17 Outer pipe surfaces should be heat-insulated from the possible condensate appearance on the surfaces.

18 Mentioned works are to be implemented in the course of separate projects, so these works are not included in the present package of working documentation.

19 Construction part is performed by according to package 1 4 4 12.

\* Amendment Number 1 was introduced into sheets 1..16.

\* Amendment Number 1 was introduced into sheets 1..16.



Принят Ascerted	Bukanov	 FSUE "Atomenergoproekt" Moscow 2004					 NUCLEAR POWER CORPORATION OF INDIA LTD						
	Arch. No		Date										
При переписке в ссылке на документ (лист документа) следует указывать его обозначение, приведенное в основной надписи			Данный чертёж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлгазопроект"				R37.KK.1 2UQZ.PEB.TW.OK.WDO01  АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1						
In correspondence referring to the document (sheet of the document) it is necessary to specify its designation, given in the basic inscription			This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"				1 2UQZ Металлические конструкции трубопроводов ответственных потребителей			Стадия	Лист	Листов	
			Утвердил Approved Н. комп. Inspector Разработ. Designed			Koshecheva  Alfimova  Kondratyev		1 2UQZ Metalwork Pipelines of essential services			Phase	Sheet	Sheets
								Общие данные General data			WD	1	16
											Joint-stock Company "Institute Hydroproject" Деловая 2004		

СХЕМА ТРУБОПРОВОДОВ  
LAYOUT OF PIPELINES

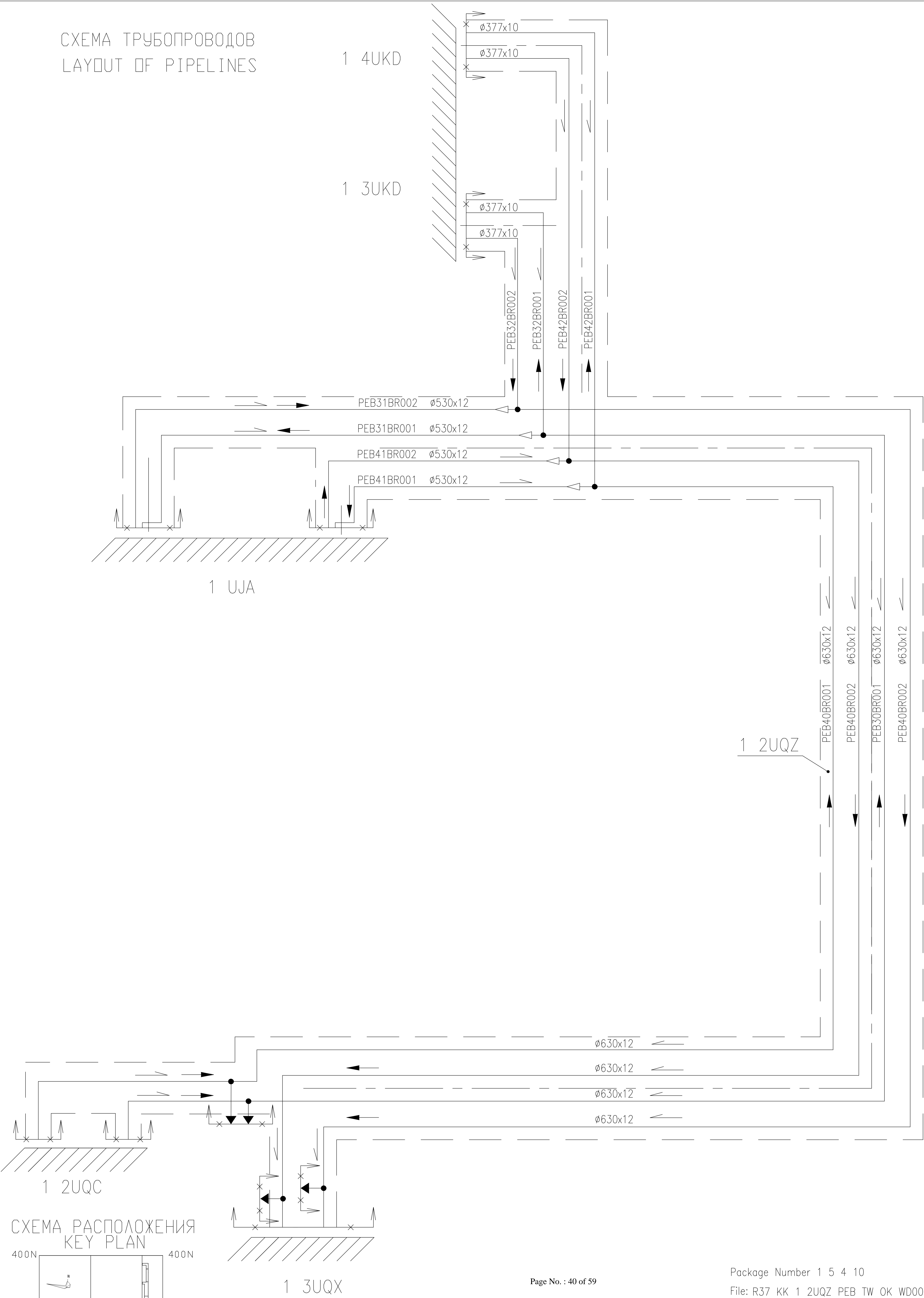
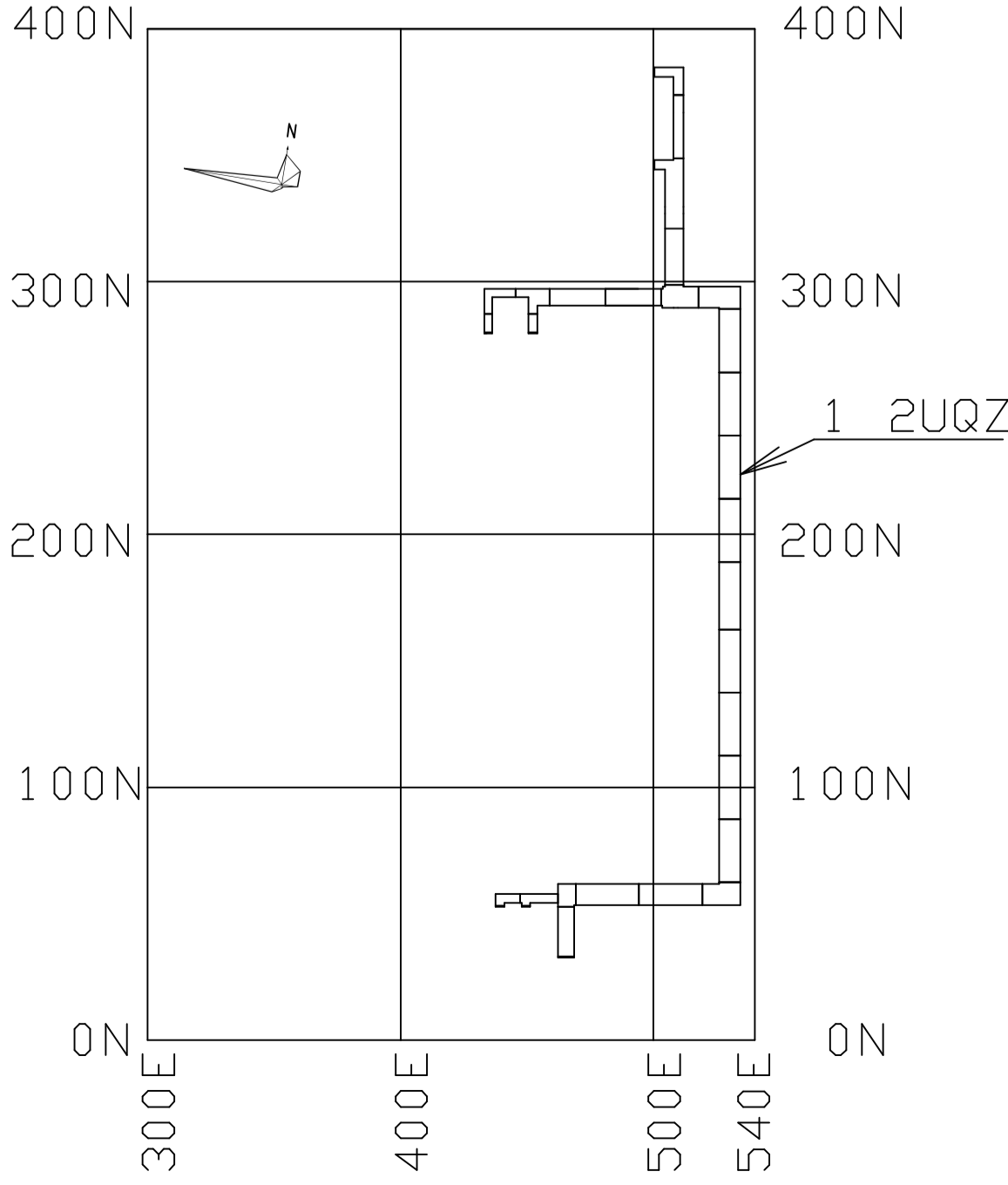


СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



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2614	656
Date	
15.03.2004	

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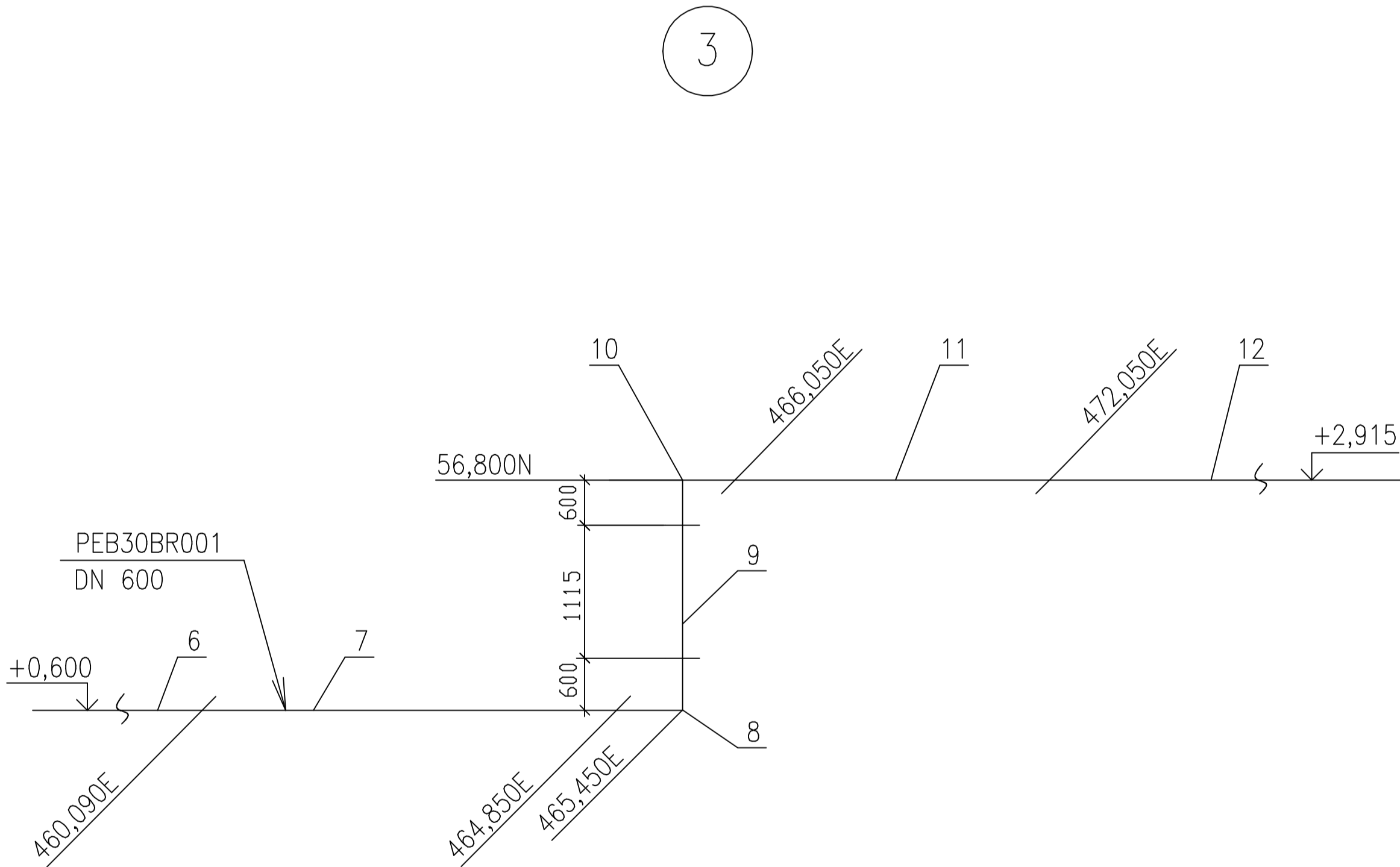
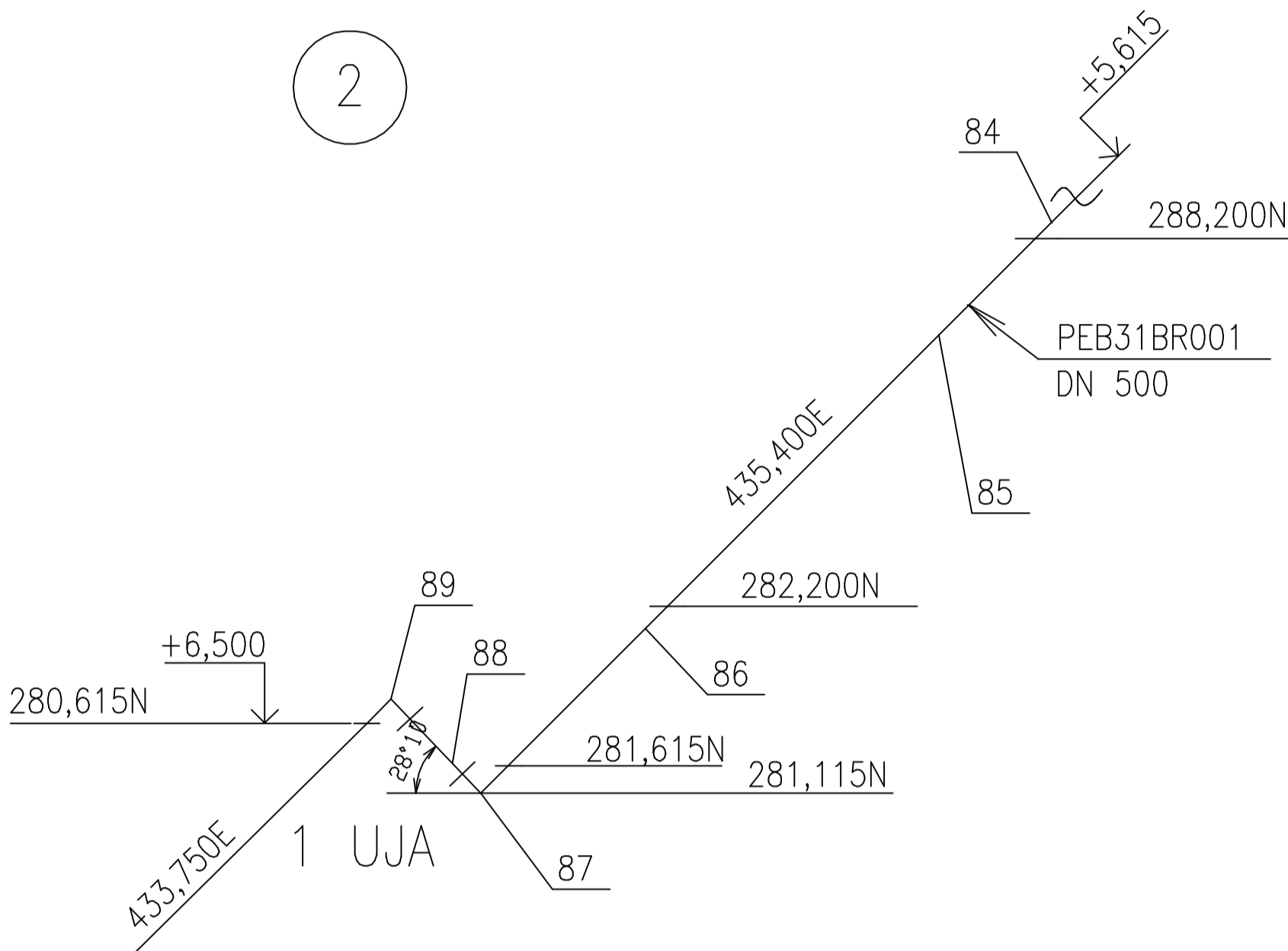
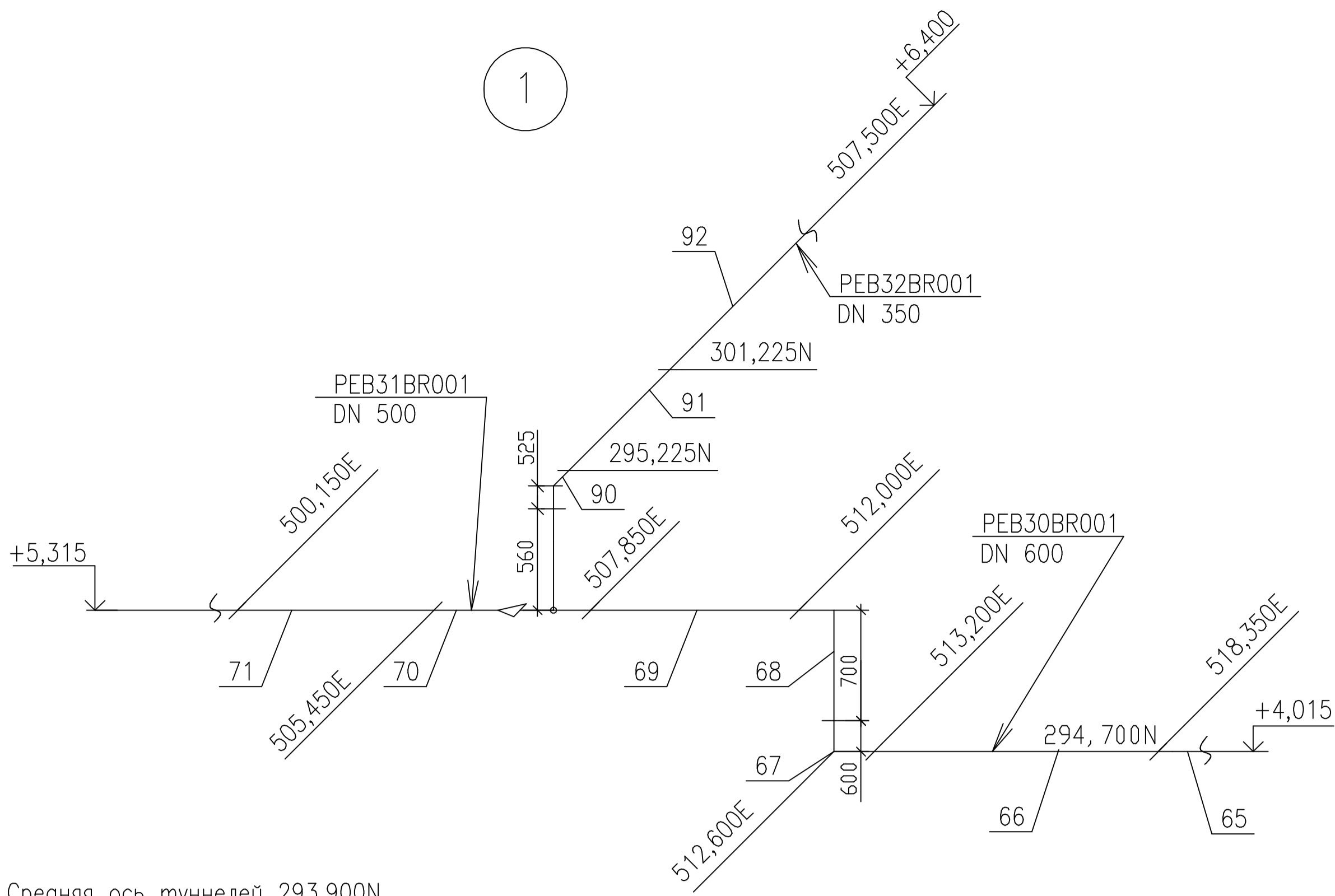
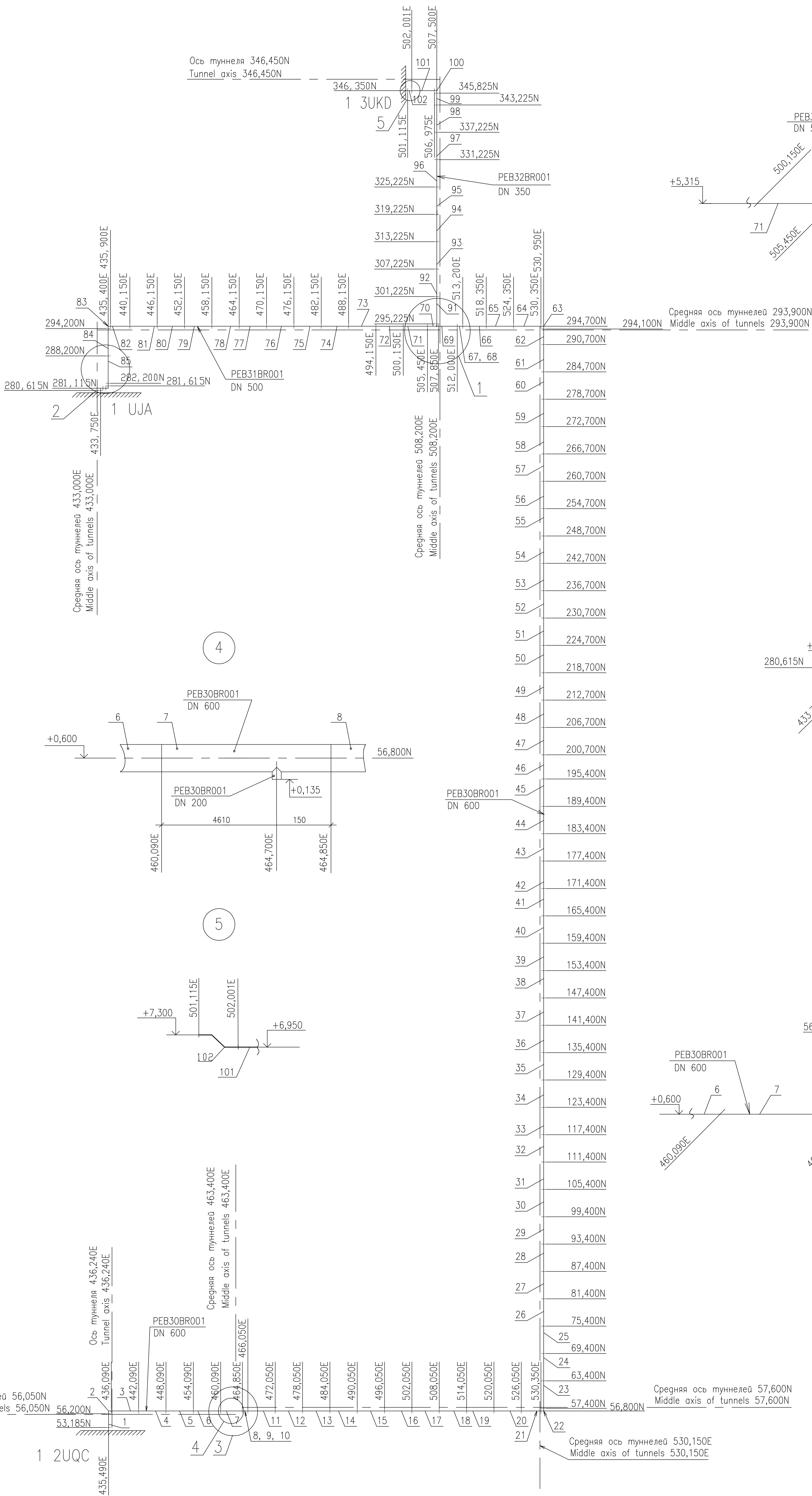
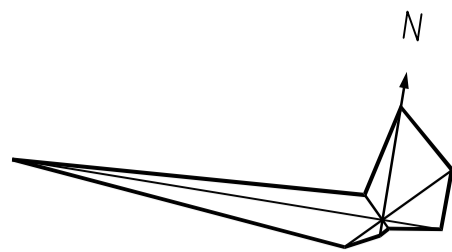
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1	—	Repl.	2-04		
Изм.	N уч.	Лист	N гок.	Подпись	Дата
Rev.	N pat.	Sheet	Doc. No	Signature	Date
Утвердил	Kondratyev				
Approved					
Н. комп.	Alfimova				
Inspector					
Разраб.					
Designed	Kravchenko				

R37.KK.1 2UQZ.PEB.TW.OK.WD001			
АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT 1			
1 2UQZ Металлические конструкции трубопроводов ответственных потребителей	Стация	Лист	Листов
	Phase	Sheet	Sheets
1 2UQZ Metalwork Pipelines of essential services	WD	2	
Схема трубопроводов Layout of pipelines	Joint-stock Company "Institute Hydroproject" Dedovsk 2004		



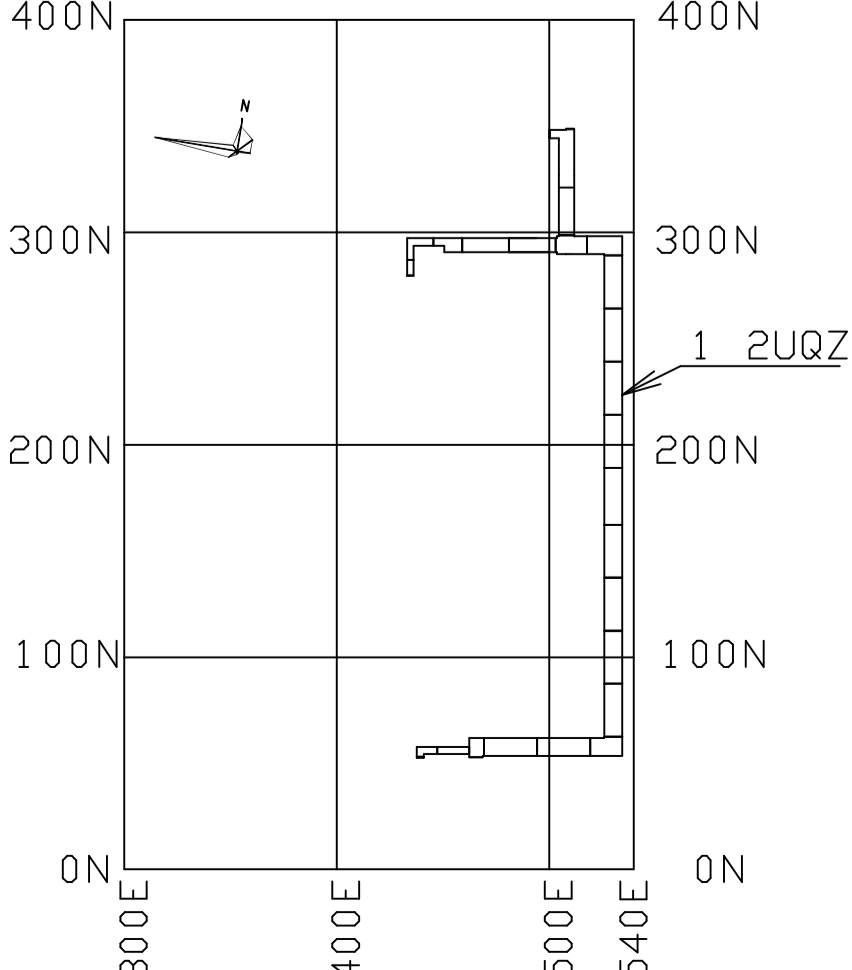
ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ РЕВ30ВR001, РЕВ31ВR001, РЕВ32ВR001 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES РЕВ30ВR001, РЕВ31ВR001, РЕВ32ВR001



- 1 Строительные конструкции туннелей условно не показаны.  
2 Общий план трубопроводов смотри лист 3.  
3 Спецификацию блоков смотри лист 5.  
4 В узлах 1...5 даны отметки осей трубопроводов.

- 1 Constructions of tunnels are not shown schematically.  
2 General plan of pipelines (Ref. Sheet 3).  
3 Blocks specification (Ref. Sheet 5).  
4 In units 1...5 axes marks of pipelines are given.

СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



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2614		15.03.2004	656

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					АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT 1							
	1	—	Repl.	2-04	1 2UQZ Металлические конструкции трубопроводов ответственных потребителей				Статус	Лист	Листов	
	Изм.	N	уч.	Лист	N	год	Подпись	Дата				
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"	Rev.	N	pat.	Sheet	Doc. No	Signature	Date	1 2UQZ Metalwork Pipelines of essential services		Phase	Sheet	Sheets
	Умвергил Approved					Kondratyev				WD	4	
	И. контр. Inspector					Alifimova		План разбивки трубопроводов РЕВ30ВR001, РЕВ31ВR001, РЕВ32ВR001 на блоки Block division plan of pipelines PE30ВR001, PEВ31ВR001, РЕВ32ВR001		Joint-stock Company "Institute Hydroproject" Dedovsk 2004		
	Разраб. Designed					Kravchenko						

## BLOCKS SPECIFICATION OF PIPELINES

1 Номера позиций данной спецификации соответствуют нумерации блоков на листе 4.

2 В графе "Обозначение" дано обозначение чертежей блоков завода-изготовителя.

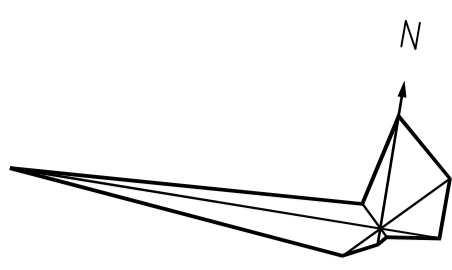
3 В графе "Наименование" дано обозначение блоков по KKS.

1 Position numbers of this specification correspond with blocks numeration on Sheet 4.

2 In column "Designation" the description of manufacturing plant drawings of blocks is given.

3 In column "Name" designation of blocks according to KKS is given.

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							АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1				
	1	—	Repl.	2-04			1 2UQZ	Металлические конструкции трубопроводов ответственных потребителей	Страница	Листы	Листов
	Изм.	Н. уч.	Листы	Н. гов.	Погнущ	Дата					
	Rev.	N. pat.	Sheet	Doc. No	Signature	Date			Phase	Sheet	Sheets
	Умбегули Approved	Kondratyev					1 2UQZ	Metalwork Pipelines of essential services	WD	5	
	Н. комп. Inspector	Alifimova					Спецификация блоков трубопроводов PEB30B001, PEB31B001, PEB32B001 Blocks specification of pipelines PEB30B001, PEB31B001, PEB32B001				
Позабо. Designed	Kravchenko					Joint-stock Company "Institute Hydroproject" Dedovsk 2004					



ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ РЕВ30ВR002, РЕВ31ВR002, РЕВ32ВR002 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES РЕВ30ВR002, РЕВ31ВR002, РЕВ32ВR002

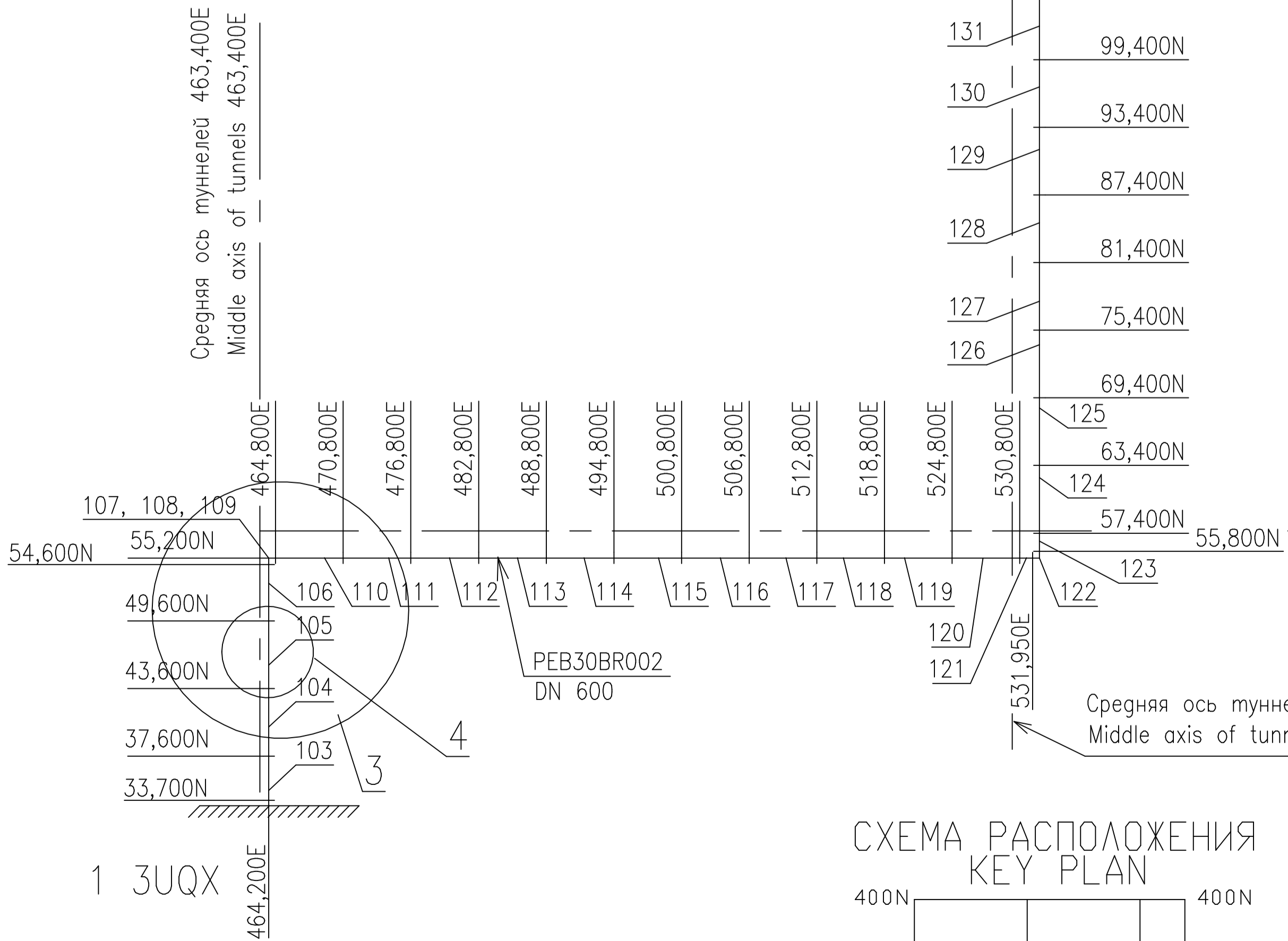
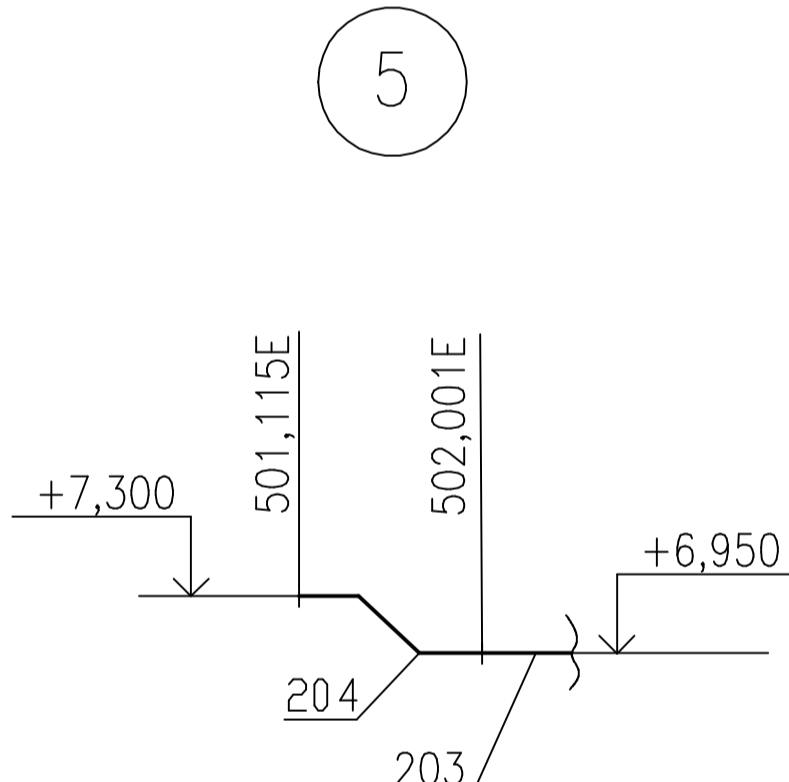
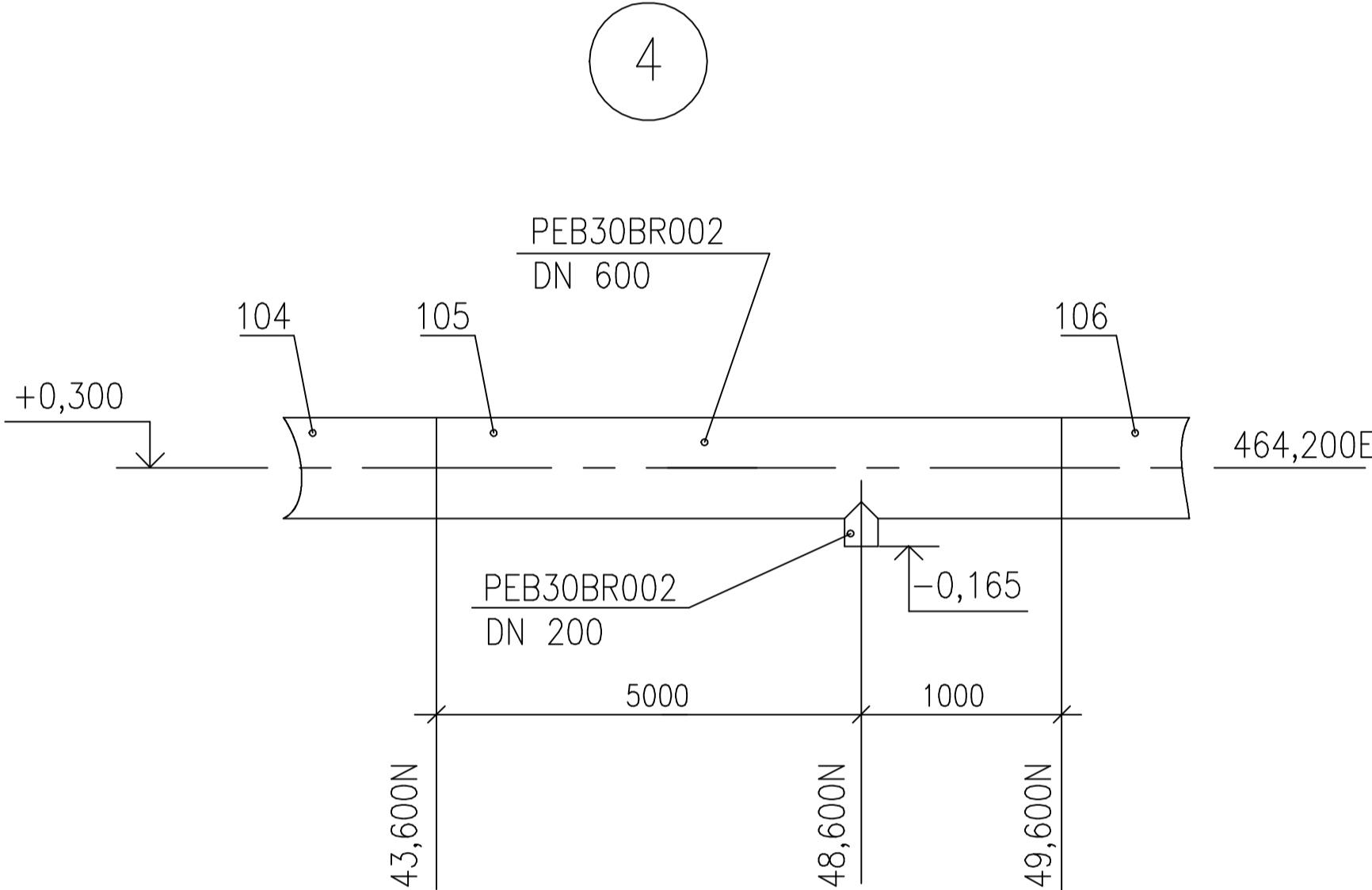
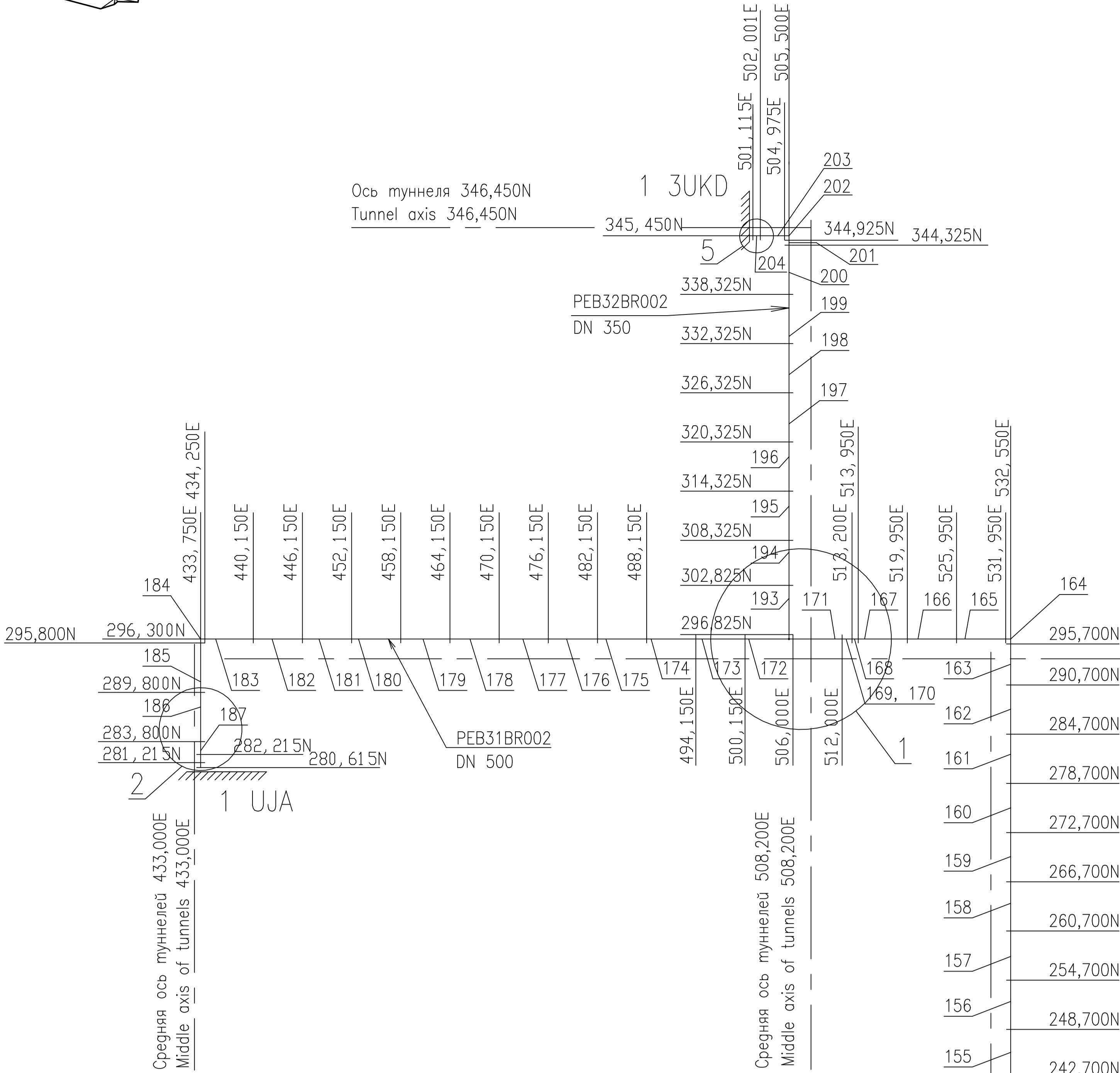
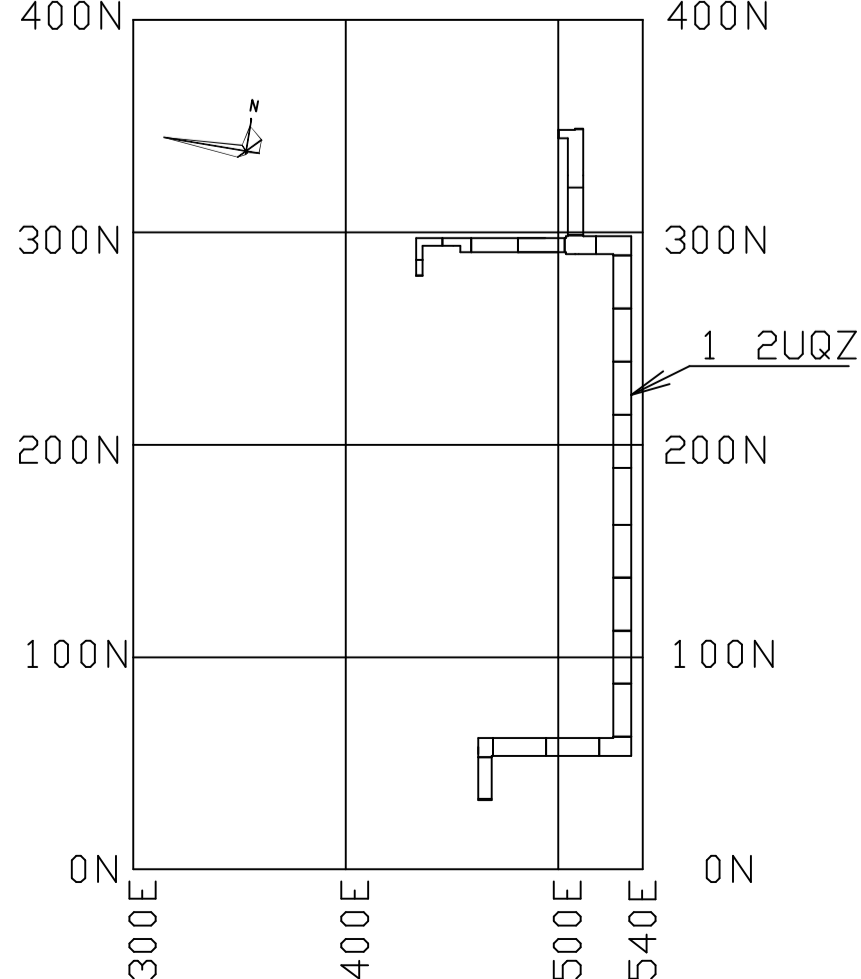
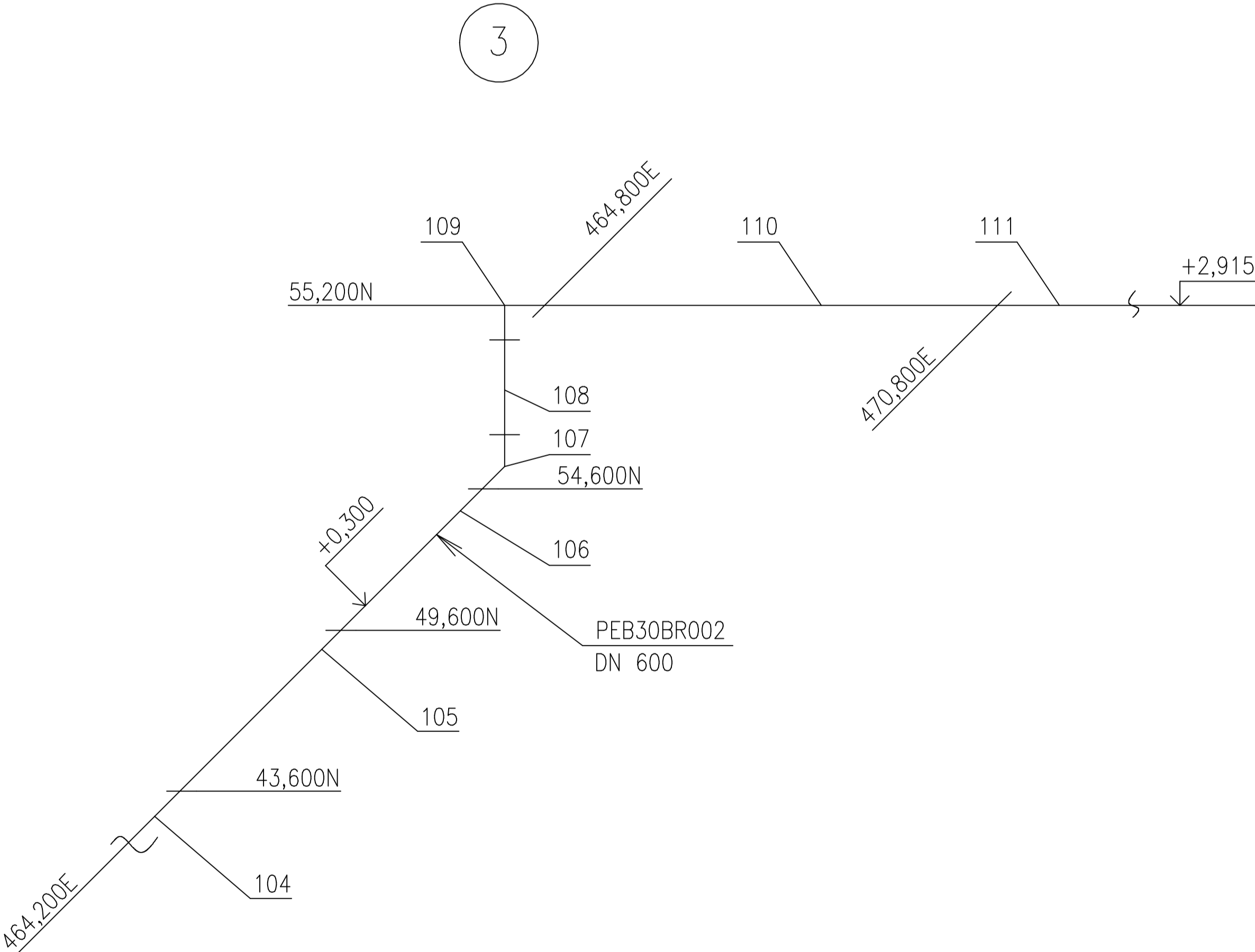
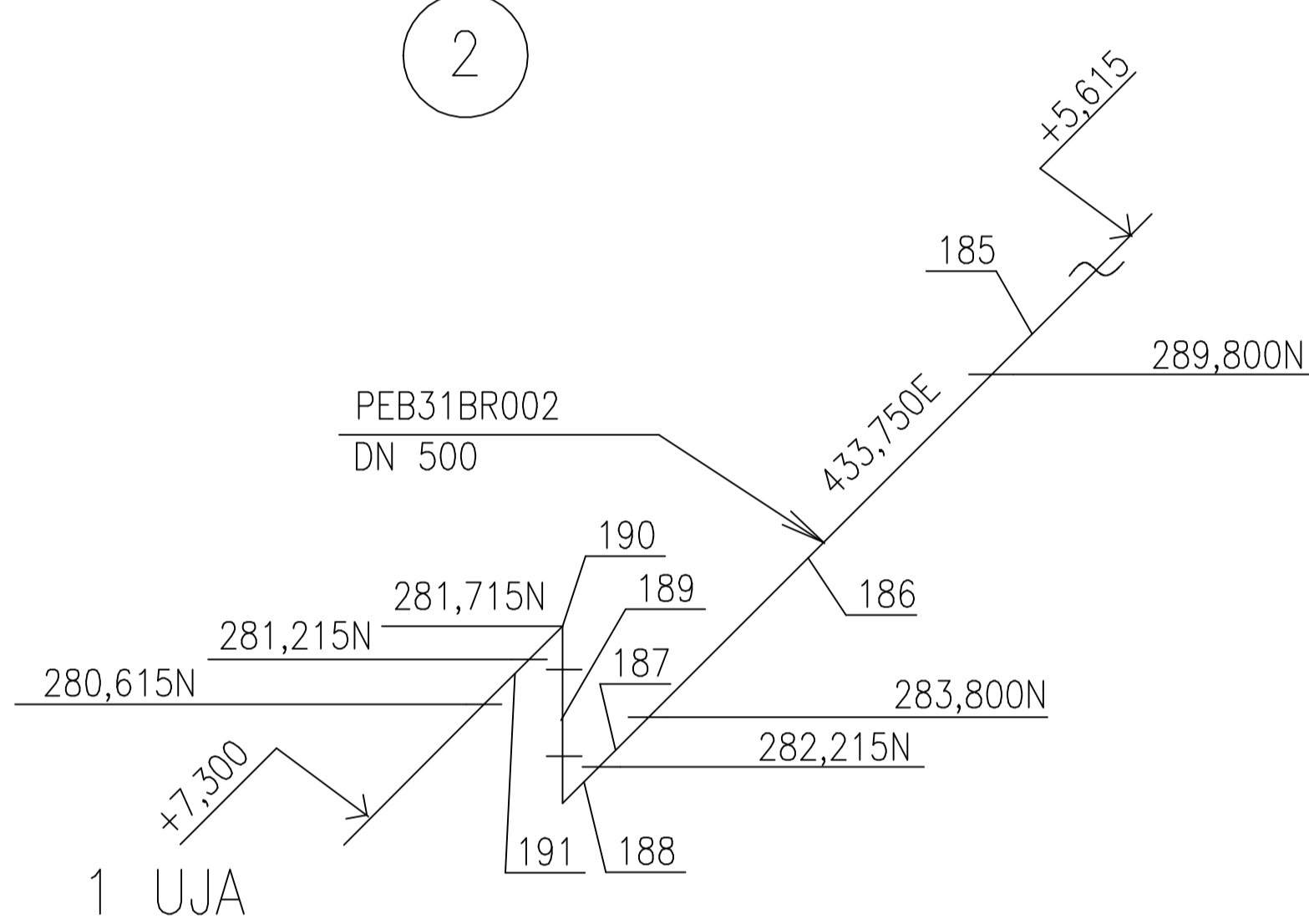
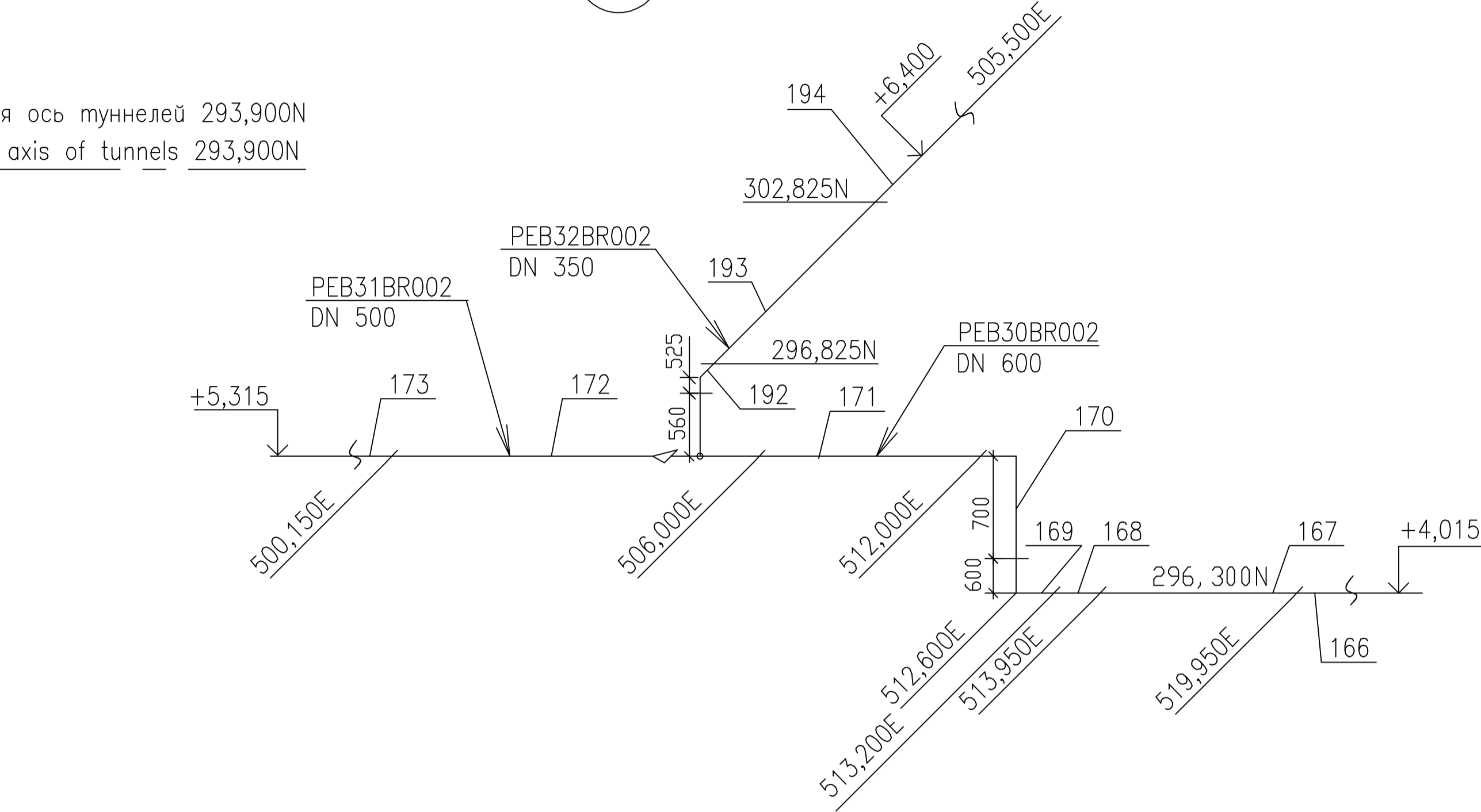


СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



Средняя ось туннелей 293,900N  
Middle axis of tunnels 293,900N



- 1 Строительные конструкции туннелей условно не показаны.  
2 Общий план трубопроводов смотри лист 3.  
3 Спецификацию блоков смотри лист 7.  
4 В узлах 1...5 даны отметки осей трубопроводов.

- 1 Constructions of tunnels are not shown schematically.  
2 General plan of pipelines (Ref. Sheet 3).  
3 Blocks specification (Ref. Sheet 7).  
4 In units 1...5 axes marks of pipelines are given.

Drig.	arch.	Nr.	Date	Replace orth.
2614			15.03.2004	656

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					АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT 1									
	1	—	Repl.	2—04		1 2UQZ Металлические конструкции трубопроводов ответственных потребителей				Стадия	Лист	Листов		
	Изм.	N	уч.	Лист	N	год	Подпись	Дата						
This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"	Rev.	N	pat.	Sheet	Doc. No	Signature	Date	1 2UQZ Metalwork Pipelines of essential services				Phase	Sheet	Sheets
	Умвергил Approved				Kondratyev				План разбивки трубопроводов РЕВ30ВR002, РЕВ31ВR002, РЕВ32ВR002 на блоки Block division plan of pipelines PE30BR002, PEB31BR002, PEB32BR002		WD	6		
	Ин. комп. Inspector				Alfimova						Joint-stock Company "Institute Hydroproject"			
	Разработ. Designed				Kravchenko						Dedovsk 2004			

СПЕЦИФИКАЦИЯ БЛОКОВ ТРУБОПРОВОДОВ  
PEB30BR002, PEB31BR002, PEB32BR002

BLOCKS SPECIFICATION OF PIPELINES  
PEB30BR002, PEB31BR002, PEB32BR002

Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. Unit weight, kg	Примечание Note	Поз. Pos.	Обозначение Designation	Наименование Name of Block	Кол. Q—ty	Масса, ед. Unit weight, kg	Примечание Note
175	HC5147.01.00.03 — 18	Труба PEB31BR002MR175 Pipe PEB31BR002MR175	1	928,8		145	HC5147.01.00.01 — 99	Труба PEB30BR002MR145 Pipe PEB30BR002MR145	1	1113,0		124	HC5147.01.00.01 — 78	Труба PEB30BR002MR124 Pipe PEB30BR002MR124	1	1113,0		103	HC5147.01.00.01 — 61	Труба PEB30BR002MR103 Pipe PEB30BR002MR103	1	742,0	
176	HC5147.01.00.03 — 19	Труба PEB31BR002MR176 Pipe PEB31BR002MR176	1	928,8		146	HC5147.01.00.01 — 100	Труба PEB30BR002MR146 Pipe PEB30BR002MR146	1	1113,0		125	HC5147.01.00.01 — 79	Труба PEB30BR002MR125 Pipe PEB30BR002MR125	1	1113,0		104	HC5147.01.00.01 — 62	Труба PEB30BR002MR104 Pipe PEB30BR002MR104	1	1113,0	
177	HC5147.01.00.03 — 20	Труба PEB31BR002MR177 Pipe PEB31BR002MR177	1	928,8		147	HC5147.01.00.01 — 101	Труба PEB30BR002MR147 Pipe PEB30BR002MR147	1	983,2		126	HC5147.01.00.01 — 80	Труба PEB30BR002MR126 Pipe PEB30BR002MR126	1	1113,0		105	HC5147.01.05.00	Блок PEB30BR002MR105 Block PEB30BR002MR105	1	1132,0	
178	HC5147.01.00.03 — 21	Труба PEB31BR002MR178 Pipe PEB31BR002MR178	1	928,8		148	HC5147.01.00.01 — 102	Труба PEB30BR002MR148 Pipe PEB30BR002MR148	1	1113,0		127	HC5147.01.00.01 — 81	Труба PEB30BR002MR127 Pipe PEB30BR002MR127	1	1113,0		106	HC5147.01.00.01 — 63	Труба PEB30BR002MR106 Pipe PEB30BR002MR106	1	927,5	
179	HC5147.01.00.03 — 22	Труба PEB31BR002MR179 Pipe PEB31BR002MR179	1	928,8		149	HC5147.01.00.01 — 103	Труба PEB30BR002MR149 Pipe PEB30BR002MR149	1	1113,0		128	HC5147.01.00.01 — 82	Труба PEB30BR002MR128 Pipe PEB30BR002MR128	1	1113,0		107	HC5147.01.00.02 — 06	Отвод PEB30BR002MR107 Pipe—bend PEB30BR002MR107	1	195,5	
180	HC5147.01.00.03 — 23	Труба PEB31BR002MR180 Pipe PEB31BR002MR180	1	928,8		150	HC5147.01.00.01 — 104	Труба PEB30BR002MR150 Pipe PEB30BR002MR150	1	1113,0		129	HC5147.01.00.01 — 83	Труба PEB30BR002MR129 Pipe PEB30BR002MR129	1	1113,0		108	HC5147.01.00.01 — 64	Труба PEB30BR002MR108 Pipe PEB30BR002MR108	1	262,5	
181	HC5147.01.00.03 — 24	Труба PEB31BR002MR181 Pipe PEB31BR002MR181	1	928,8		151	HC5147.01.00.01 — 105	Труба PEB30BR002MR151 Pipe PEB30BR002MR151	1	1113,0		130	HC5147.01.00.01 — 84	Труба PEB30BR002MR130 Pipe PEB30BR002MR130	1	1113,0		109	HC5147.01.00.02 — 07	Отвод PEB30BR002MR109 Pipe—bend PEB30BR002MR109	1	195,5	
182	HC5147.01.00.03 — 25	Труба PEB31BR002MR182 Pipe PEB31BR002MR182	1	928,8		152	HC5147.01.00.01 — 106	Труба PEB30BR002MR152 Pipe PEB30BR002MR152	1	1113,0		131	HC5147.01.00.01 — 85	Труба PEB30BR002MR131 Pipe PEB30BR002MR131	1	1113,0		110	HC5147.01.00.01 — 65	Труба PEB30BR002MR110 Pipe PEB30BR002MR110	1	1113,0	
183	HC5147.01.00.03 — 26	Труба PEB31BR002MR183 Pipe PEB31BR002MR183	1	928,8		153	HC5147.01.00.01 — 107	Труба PEB30BR002MR153 Pipe PEB30BR002MR153	1	1113,0		132	HC5147.01.00.01 — 86	Труба PEB30BR002MR132 Pipe PEB30BR002MR132	1	1113,0		111	HC5147.01.00.01 — 66	Труба PEB30BR002MR111 Pipe PEB30BR002MR111	1	1113,0	
184	HC5147.01.00.04 — 03	Отвод PEB31BR002MR184 Pipe—bend PEB31BR002MR184	1	130,0		154	HC5147.01.00.01 — 108	Труба PEB30BR002MR154 Pipe PEB30BR002MR154	1	1113,0		133	HC5147.01.00.01 — 87	Труба PEB30BR002MR133 Pipe PEB30BR002MR133	1	1113,0		112	HC5147.01.00.01 — 67	Труба PEB30BR002MR112 Pipe PEB30BR002MR112	1	1113,0	
185	HC5147.01.00.03 — 27	Труба PEB31BR002MR185 Pipe PEB31BR002MR185	1	928,8		155	HC5147.01.00.01 — 109	Труба PEB30BR002MR155 Pipe PEB30BR002MR155	1	1113,0		134	HC5147.01.00.01 — 88	Труба PEB30BR002MR134 Pipe PEB30BR002MR134	1	1113,0		113	HC5147.01.00.01 — 68	Труба PEB30BR002MR113 Pipe PEB30BR002MR113	1	1113,0	
186	HC5147.01.00.03 — 28	Труба PEB31BR002MR186 Pipe PEB31BR002MR186	1	928,8		156	HC5147.01.00.01 — 110	Труба PEB30BR002MR156 Pipe PEB30BR002MR156	1	1113,0		135	HC5147.01.00.01 — 89	Труба PEB30BR002MR135 Pipe PEB30BR002MR135	1	1113,0		114	HC5147.01.00.01 — 69	Труба PEB30BR002MR114 Pipe PEB30BR002MR114	1	1113,0	
187	HC5147.01.00.03 — 29	Труба PEB31BR002MR187 Pipe PEB31BR002MR187	1	261,0		157	HC5147.01.00.01 — 111	Труба PEB30BR002MR157 Pipe PEB30BR002MR157	1	1113,0		136	HC5147.01.00.01 — 90	Труба PEB30BR002MR136 Pipe PEB30BR002MR136	1	1113,0		115	HC5147.01.00.01 — 70	Труба PEB30BR002MR115 Pipe PEB30BR002MR115	1	1113,0	
188	HC5147.01.00.04 — 04	Отвод PEB31BR002MR188 Pipe—bend PEB31BR002MR188	1	130,0		158	HC5147.01.00.01 — 112	Труба PEB30BR002MR158 Pipe PEB30BR002MR158	1	1113,0		137	HC5147.01.00.01 — 91	Труба PEB30BR002MR137 Pipe PEB30BR002MR137	1	1113,0		116	HC5147.01.00.01 — 71	Труба PEB30BR002MR116 Pipe PEB30BR002MR116	1	1113,0	
189	HC5147.01.00.03 — 30	Труба PEB31BR002MR189 Pipe PEB31BR002MR189	1	106,0		159	HC5147.01.00.01 — 113	Труба PEB30BR002MR159 Pipe PEB30BR002MR159	1	1113,0		138	HC5147.01.00.01 — 92	Труба PEB30BR002MR138 Pipe PEB30BR002MR138	1	1113,0		117	HC5147.01.00.01 — 72	Труба PEB30BR002MR117 Pipe PEB30BR002MR117	1	1113,0	
190	HC5147.01.00.04 — 05	Отвод PEB31BR002MR190 Pipe—bend PEB31BR002MR190	1	130,0		160	HC5147.01.00.01 — 114	Труба PEB30BR002MR160 Pipe PEB30BR002MR160	1	1113,0		139	HC5147.01.00.01 — 93	Труба PEB30BR002MR139 Pipe PEB30BR002MR139	1	1113,0		118	HC5147.01.00.01 — 73	Труба PEB30BR002MR118 Pipe PEB30BR002MR118	1	1113,0	
191	HC5147.01.00.03 — 31	Труба PEB31BR002MR191 Pipe PEB31BR002MR191	1	92,9		161	HC5147.01.00.01 — 115	Труба PEB30BR002MR161 Pipe PEB30BR002MR161	1	1113,0		140	HC5147.01.00.01 — 94	Труба PEB30BR002MR140 Pipe PEB30BR002MR140	1	1113,0		119	HC5147.01.00.01 — 74	Труба PEB30BR002MR119 Pipe PEB30BR002MR119	1	1113,0	
192	HC5147.01.00.05 — 02	Отвод PEB32BR002MR192 Pipe—bend PEB32BR002MR192	1	93,0		162	HC5147.01.00.01 — 116	Труба PEB30BR002MR162 Pipe PEB30BR002MR162	1	1113,0		141	HC5147.01.00.01 — 95	Труба PEB30BR002MR141 Pipe PEB30BR002MR141	1	1113,0		120	HC5147.01.00.01 — 75	Труба PEB30BR002MR120 Pipe PEB30BR002MR120	1	1113,0	
193	HC5147.01.00.06 — 10	Труба PEB32BR002MR193 Pipe PEB32BR002MR193	1	543,1		163	HC5147.01.00.01 — 117	Труба PEB30BR002MR163 Pipe PEB30BR002MR163	1	946,1		142	HC5147.01.00.01 — 96	Труба PEB30BR002MR142 Pipe PEB30BR002MR142	1	1113,0		121	HC5147.01.00.01 — 76	Труба PEB30BR002MR121 Pipe PEB30BR002MR121	1	231,9	
194	HC5147.01.00.06 — 11	Труба PEB32BR002MR194 Pipe PEB32BR002MR194	1	497,8		164	HC5147.01.00.02 — 09	Отвод PEB30BR002MR164 Pipe—bend PEB30BR002MR164	1	195,5		143	HC5147.01.00.01 — 97	Труба PEB30BR002MR143 Pipe PEB30BR002MR143	1	1113,0		122	HC5147.01.00.02 — 08	Отвод PEB30BR002MR122 Pipe—bend PEB30BR002MR122	1	195,5	
195	HC5147.01.00.06 — 12	Труба PEB32BR002MR195 Pipe PEB32BR002MR195	1	543,1		165	HC5147.01.00.01 — 118	Труба PEB30BR002MR165 Pipe PEB30BR002MR165	1	1113,0		144	HC5147.01.00.01 — 98	Труба PEB30BR002MR144 Pipe PEB30BR002MR144	1	1113,0		123	HC5147.01.00.01 — 77	Труба PEB30BR002MR123 Pipe PEB30BR002MR123	1	296,8	
196	HC5147.01.00.06 — 13	Труба PEB32BR002MR196 Pipe PEB32BR002MR196	1	543,1		166	HC5147.01.00.01 — 119	Труба PEB30BR002MR166 Pipe PEB30BR002MR166	1	1113,0		<div>Page No. : 45 of 59</div> <div>Package Number 1 5 4 10 File: R37 KK 1 2UQZ PEB TW OK WD001_07=1.dwg</div> <div><div><div>Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлеугропроект"</div><div>This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint—stock Company "Institute Hydroproject"</div></div><div><div><div>1 2UQZ Металлические конструкции трубопроводов отвешиваемых потребителей</div><div>1 2UQZ Metalwork Pipelines of essential service</div></div><div><div>Смагач</div><div>Phase</div><div>7</div></div><div><div>Лист</div><div>Sheet</div><div>7</div></div><div><div>Листов</div><div>Sheets</div><div></div></div></div></div>											
197	HC5147.01.00.06 — 14	Труба PEB32BR002MR197 Pipe PEB32BR002MR197	1	543,1		167	HC5147.01.00.01 — 120	Труба PEB30BR002MR167 Pipe PEB30BR002MR167	1	1113,0													
198	HC5147.01.00.06 — 15	Труба PEB32BR002MR198 Pipe PEB32BR002MR198	1	543,1		168	HC5147.01.00.01 — 121	Труба PEB30BR002MR168 Pipe PEB30BR002MR168	1	139,1													
199	HC5147.01.00.06 — 16	Труба PEB32BR002MR199 Pipe PEB32BR002MR199	1	543,1		169	HC5147.01.00.02 — 10	Отвод PEB30BR002MR169 Pipe—bend PEB30BR002MR169	1	195,5													
200	HC5147.01.00.06 — 17	Труба PEB32BR002MR200 Pipe PEB32BR002MR200	1	543,1		170	HC5147.01.02.00 — 01	Блок PEB30BR002MR170 Block PEB30BR002MR170	1	216,2													
201	HC5147.01.00.06 — 18	Труба PEB32BR002MR201 Pipe PEB32BR002MR201	1	63,4		171	HC5147.01.00.01 — 122	Труба PEB30BR002MR171 Pipe PEB30BR002MR171	1	1113,0													
202	HC5147.01.00.05 — 03	Отвод PEB32BR002MR202 Pipe—bend PEB32BR002MR202	1	93,0		172	HC5147.01.06.00	Блок PEB30BR002MR172 Block PEB30BR002MR172	1	1019,8													
203	HC5147.01.00.06 — 19	Труба PEB32BR002MR203 Pipe PEB32BR002MR203	1	269,1		173	HC5147.01.00.03 — 16	Труба PEB31BR002MR173 Pipe PEB31BR002MR173	1	928,8													
204	HC5147.01.04.00 — 01	Блок PEB32BR002MR204 Block PEB32BR002MR204	1	88,8		174	HC5147.01.00.03 — 17	Труба PEB31BR002MR174 Pipe PEB31BR002MR174	1	928,8													

1 Номера позиций данной спецификации соответствуют нумерации блоков на листе 6.  
2 В графе "Обозначение" дано обозначение чертежей блоков завода—изготовителя.  
3 В графе "Наименование" дано обозначение блоков по KKS.

1 Position numbers of this specification correspond with blocks numeration on Sheet 6.  
2 In column "Designation" the description of manufacturing plant drawings of blocks is given.  
3 In column "Name" designation of blocks according to KKS is given.

Р37.КК.1 2UQZ.PEB.TW.OK.WD001

АЭС "КУДАНКУЛАМ" БЛОК 1  
NPP "KUDANKULAM" UNIT

1 2UQZ  
Металлические конструкции трубопроводов  
отвешиваемых потребителей

1 2UQZ  
Metalwork Pipelines of essential service

Смагач

Phase

7

Лист

Sheet

7

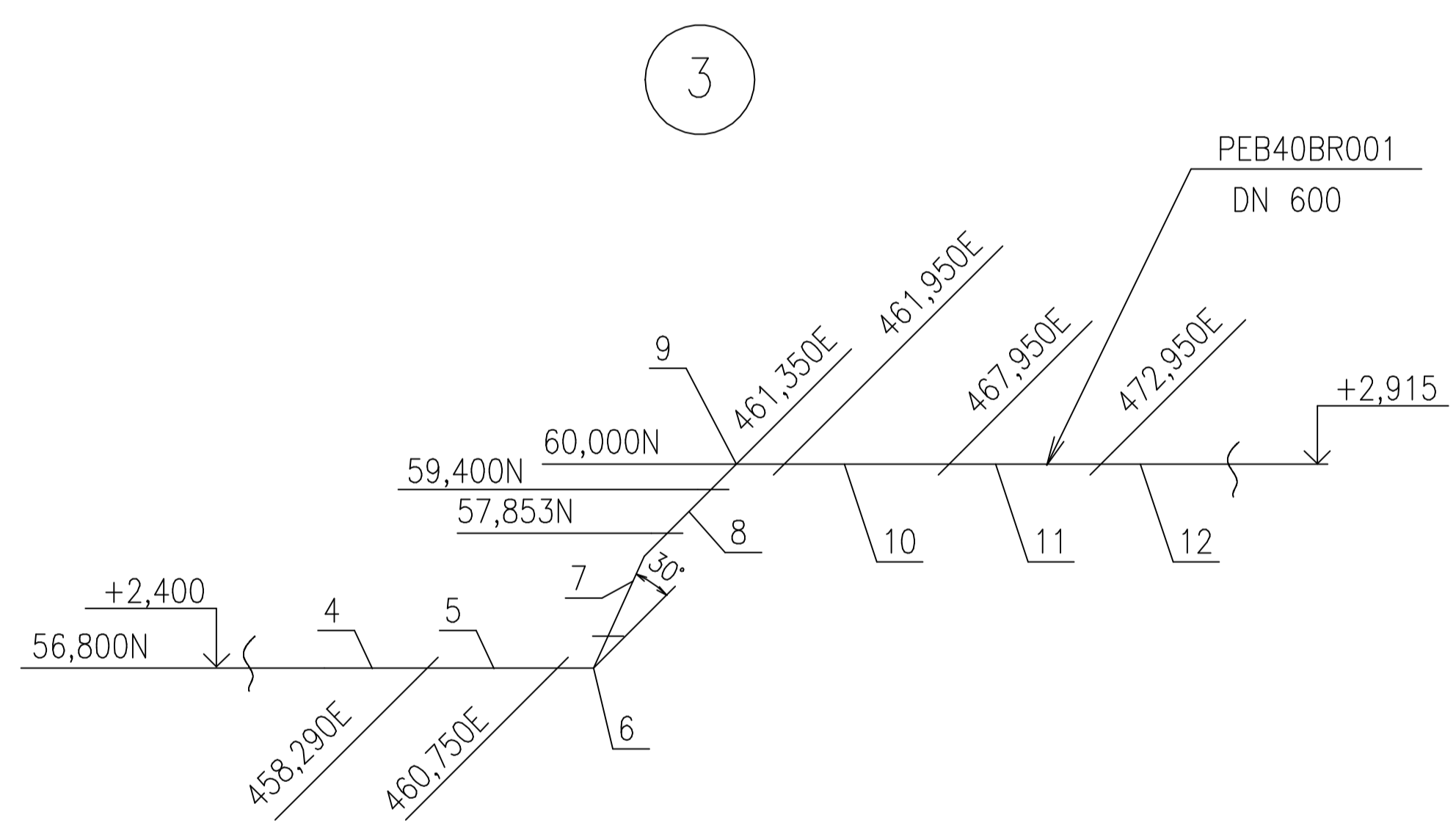
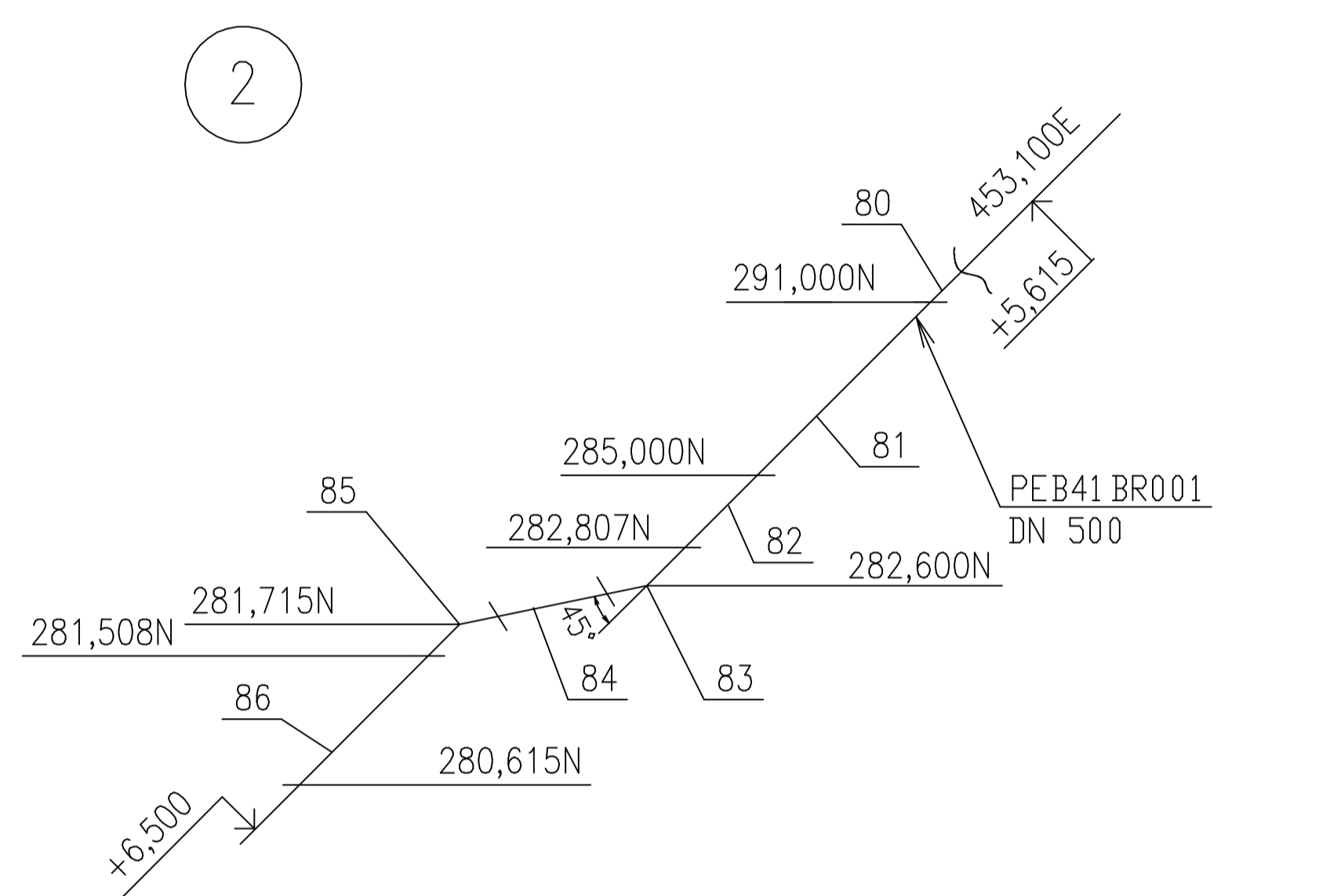
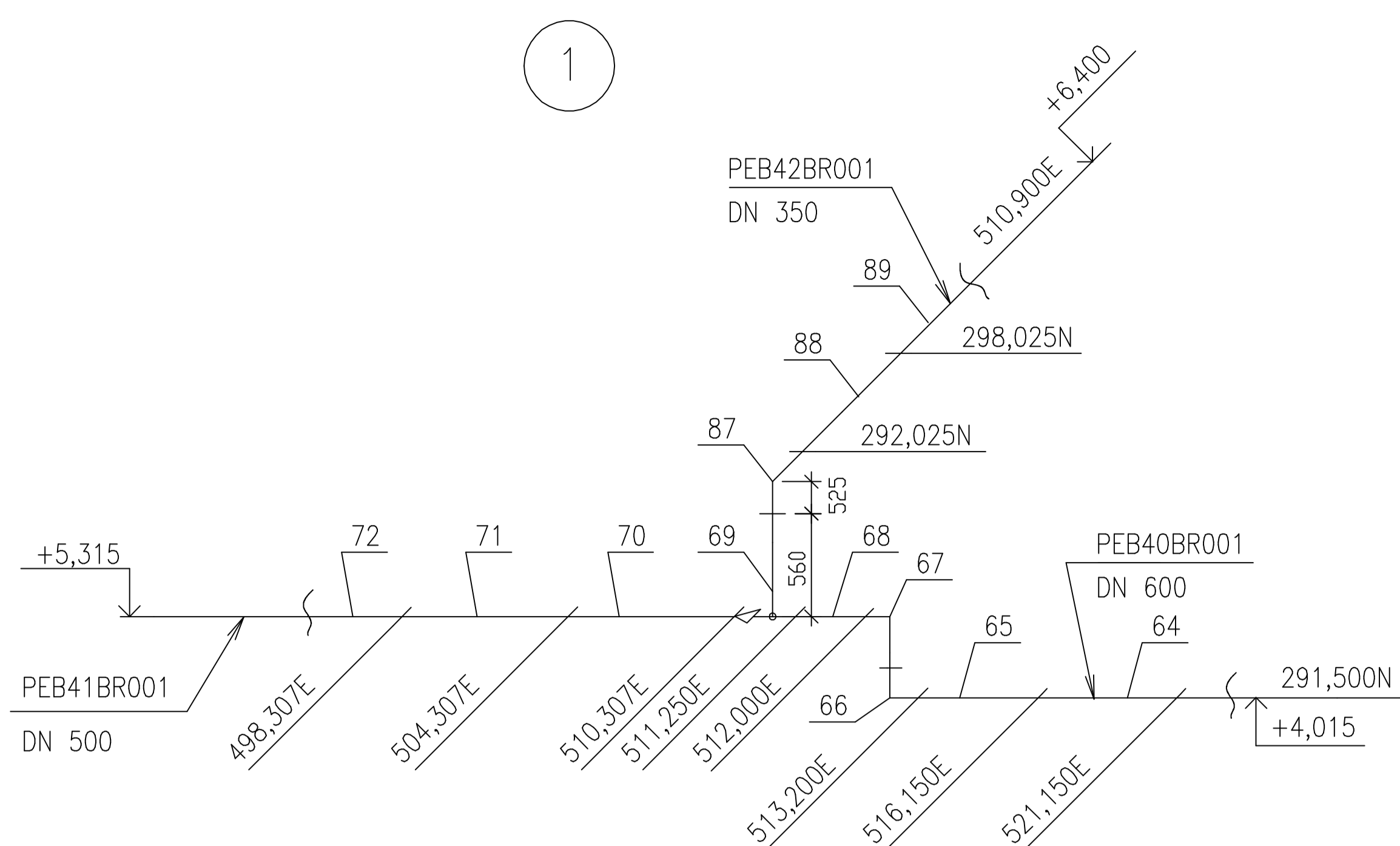
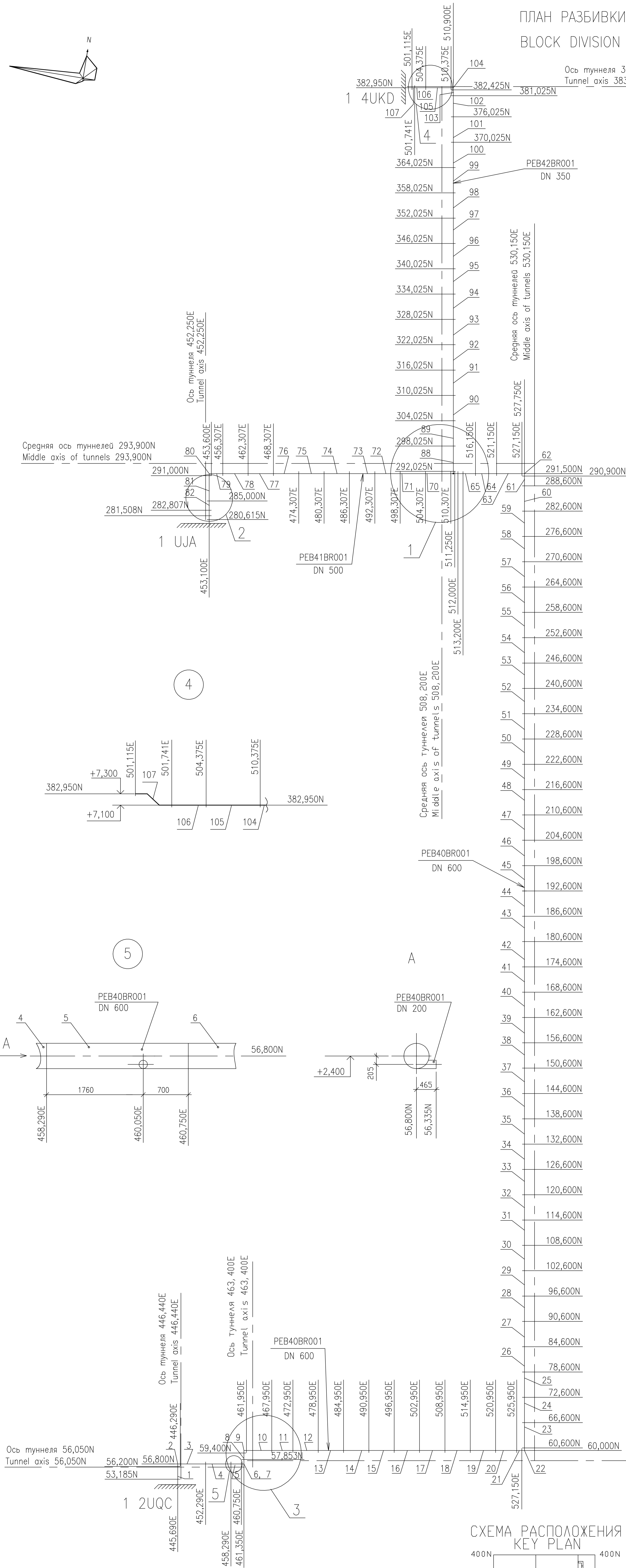
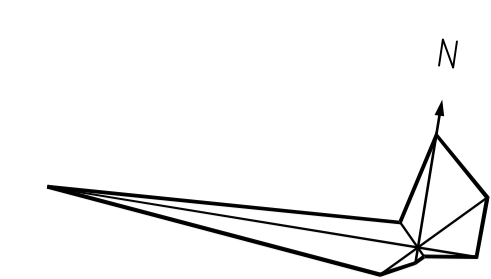
Листов

Sheets

Joint-stock Company  
"Institute Hydroproject"  
Dudovsk 2004

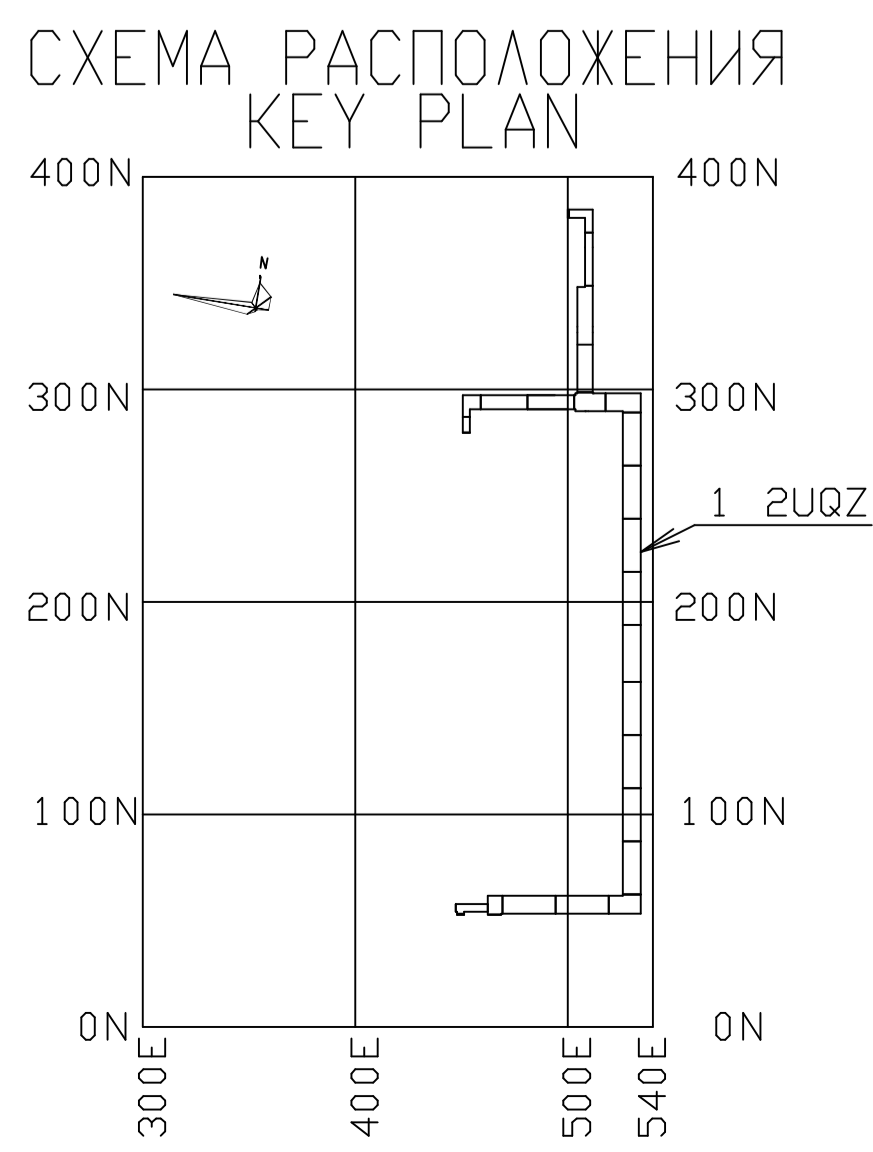
Формат А1

ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ РЕВ40ВR001, РЕВ41ВR001, РЕВ42ВR001 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES РЕВ40ВR001, РЕВ41ВR001, РЕВ42ВR001



- 1 Строительные конструкции туннелей условно не показаны.
- 2 Общий план трубопроводов смотри лист 3.
- 3 Спецификацию блоков трубопроводов смотри лист 9.
- 4 В узлах 1...5 даны отметки осей трубопроводов.

- 1 Constructions of tunnels are not shown schematically.
- 2 General plan of pipelines (Ref. Sheet 3).
- 3 Blocks specification of pipelines (Ref. Sheet 9).
- 4 In units 1...5 axes marks of pipelines are given.



Page No. : 46 of 59

Package Number 1 5 4 10  
File: R37 KK 1 2UQZ PEB TW OK WD001\_08=1.dwg

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							АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1				
	1	—	Repl.	2-04							
	Изм.	N уч.	Лист	N гок.	Погнуть	Дата	1 2UQZ Металлические конструкции трубопроводов ответственных потребителей	Смаглы	Лист	Листов	
	Rev.	N pat.	Sheet	Doc. No	Signature	Date	1 2UQZ Metalwork Pipelines of essential services	Phase	Sheet	Sheets	
	Умбэргал Approved		Kondratyev					WD	8		
	Н. комп. Inspector		Alfimova				План разбивки трубопроводов PEB40BR001, PEB41BR001, PEB42BR001 на бл. "Института Гидропроект"				
	Разработ. Designed		Kravchenko				Block division plan of pipelines PEB40BR001, PEB41BR001, PEB42BR001				
							Joint-stock Company "Institute Hydroproject" Dedovsk 2004				

Формат A1

Orig. arch.	Nr.	Date	Replace arch. Nr.
2614		15.03.2004	656

## BLOCKS SPECIFICATION OF PIPELINES

Orig. arch. Nr.	Date	Replace arch. Nr.
2614	15.03.2004	656



## BLOCKS SPECIFICATION OF PIPELINES

Orig. arch. Nr.	Date	Replace arch. Nr.
2614	15.03.2004	656

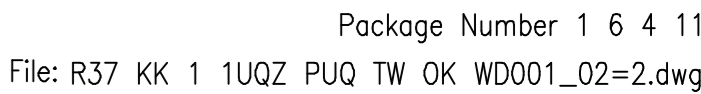
1 Position numbers of this specification correspond with blocks numeration on Sheet 10.  
2 In column "Designation" the description of manufacturing plant drawings of blocks is given.  
3 In column "Name" designation of blocks according to KKS is given.



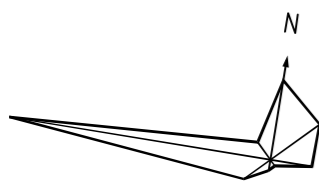
ПЕРЕЧЕНЬ ЭЛЕМЕНТОВ  
LIST OF ELEMENTS



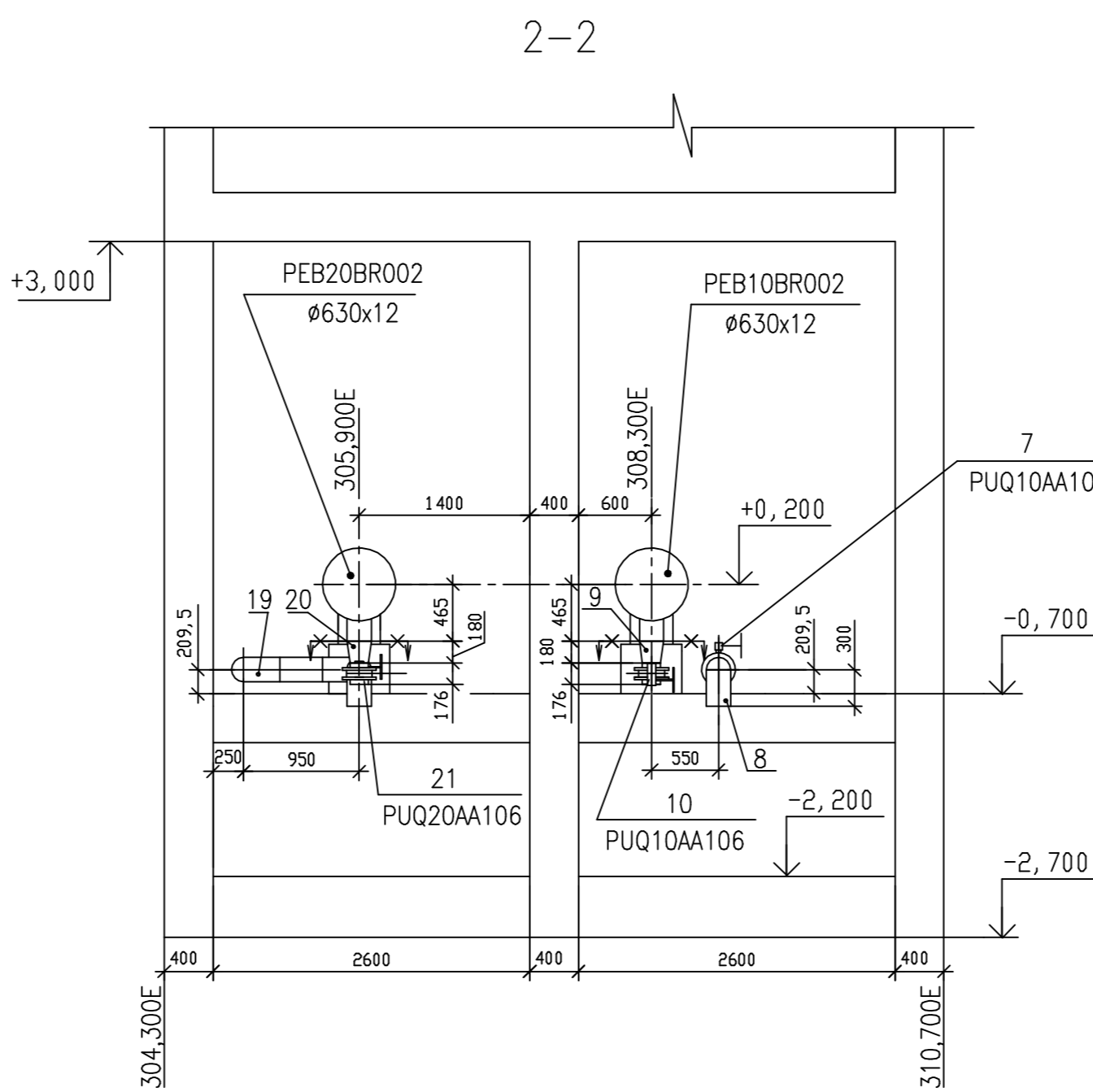
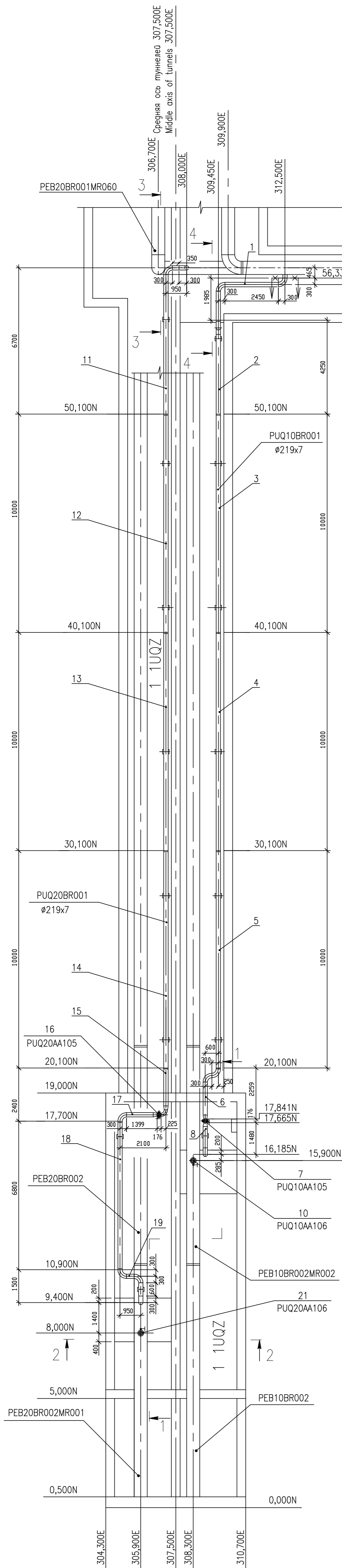
Page No. : 51 of 59



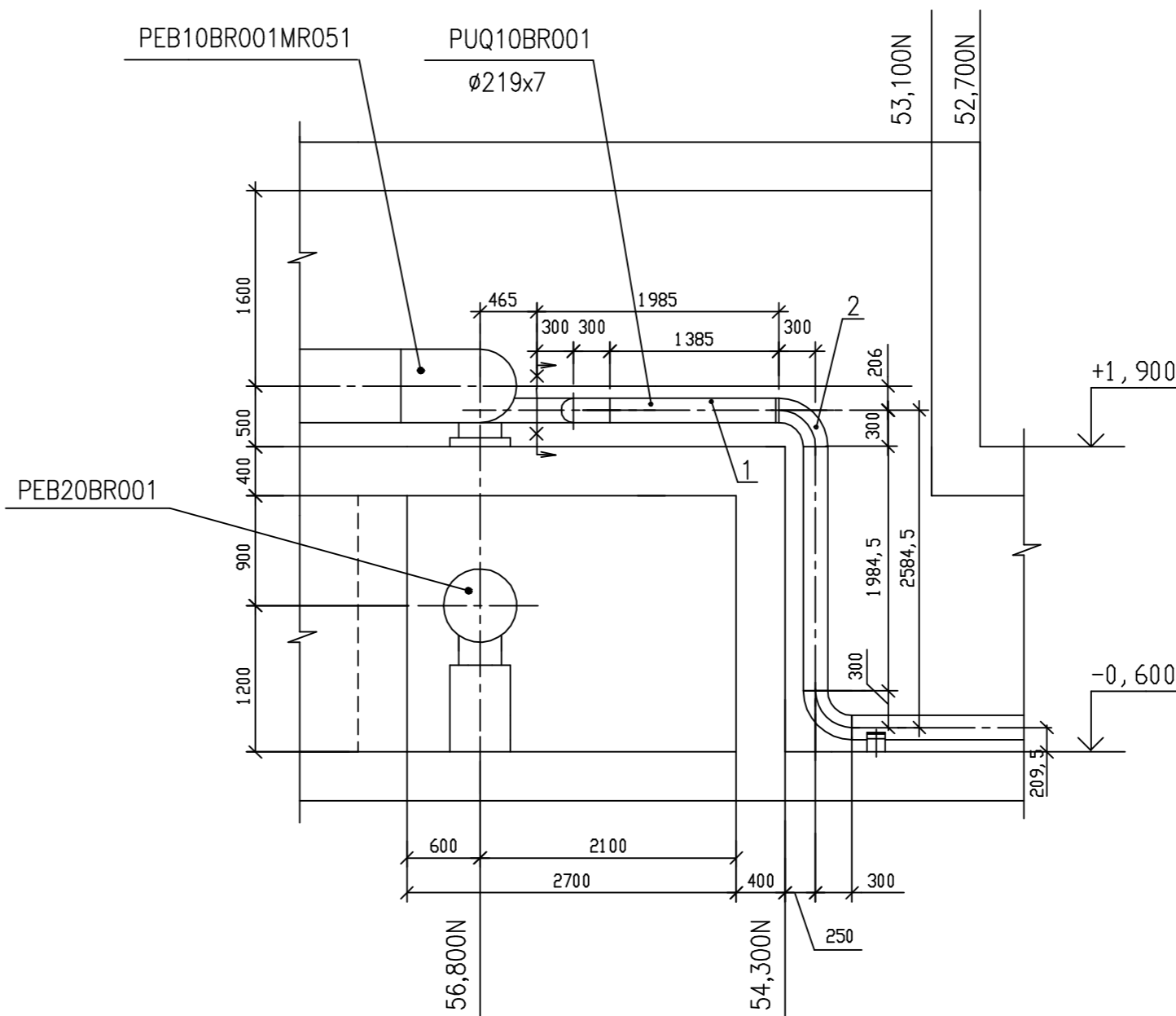
Данный чертёж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Московскийпроект"									R37.KK.1 1UQZ.PUQ.TW.OK.WD001		
	2	-	Repl	30-09					АЭС "КУДАНКУЛАМ" БЛОК НРР "KUDANKULAM" UNIT 1		
	Изм.	N	уч.	лчм.	г	погнуса	Дата	Система дренажа сбросов вод. Дренаж воды из туннелей в случае разрыва трубопровода	Cmagnac	Листы	Листов
	Rev.	N	пат.	Sht.	Doc.	No	Signature Date	1 UQZ	Phase	Sheet	Sheets
	Ymbegunay Approved	Kondratyev						Drain water removal system. Water removal from tunnels in case of pipeline break	1 UQZ	WD	2
	Н. комп. Инспектор Проект. Designed	Afitimova	Ovcharenko					Схема принципиальная Schematic diagram	Institute Stock Company "Joint-Hydroproject" Drednik 2009		
Joint-stock Company "Institute Hydroproject"									Формат А2х3		



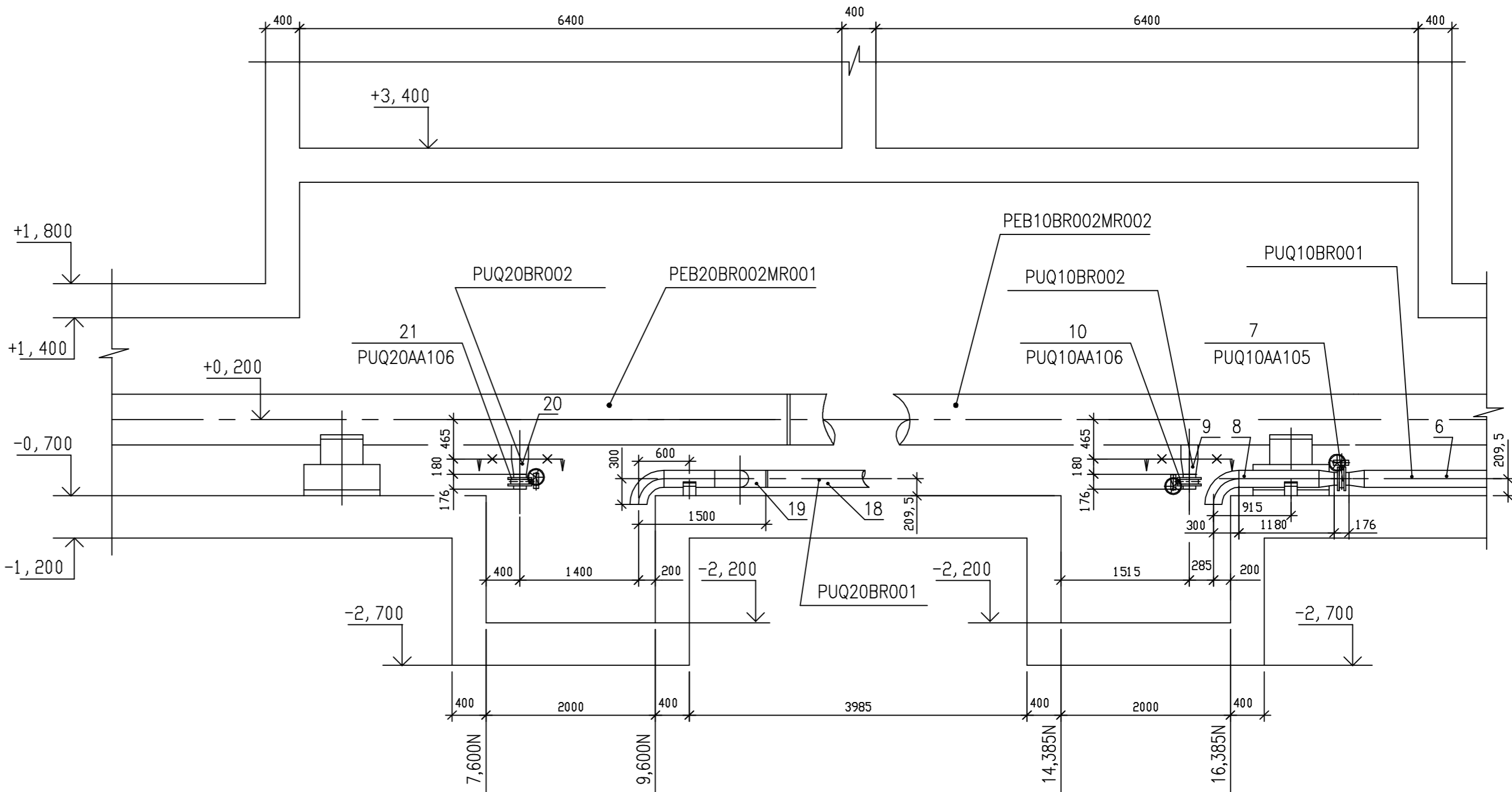
ПЛАН РАЗБИВКИ ТРУБОПРОВОДОВ PUQ10BR001,  
PUQ10BR002, PUQ20BR001, PUQ20BR002 НА БЛОКИ  
BLOCK DIVISION PLAN OF PIPELINES PUQ10BR001,  
PUQ10BR002, PUQ20BR001, PUQ20BR002



4-4

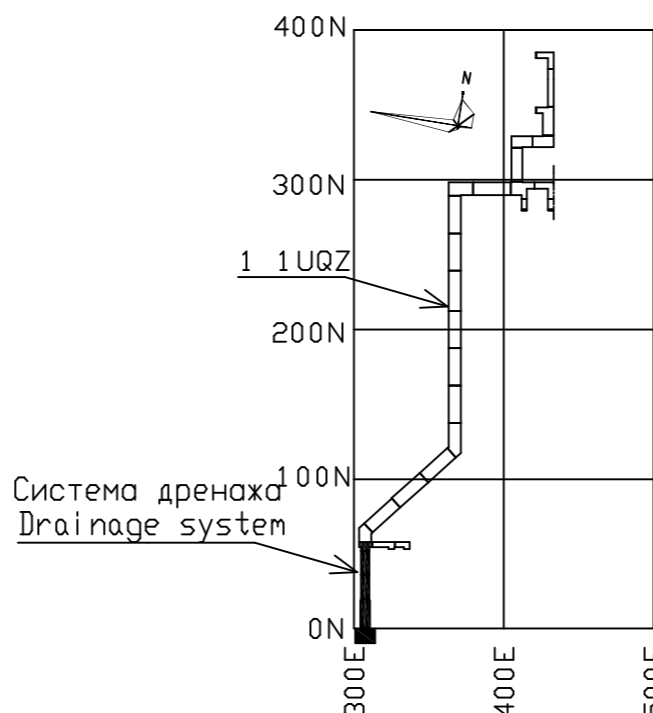


1-1



Спецификацию блоков трубопроводов смотри лист 4.  
For specification of pipelines blocks see sheet 4.

СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



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This drawing is not to be reproduced or transferred to other organizations or private persons without approval of Joint-stock Company "Institute Hydroproject"					АЭС "КУДАНКУЛАМ" БЛОК NPP "KUDANKULAM" UNIT 1		
					1 1UQZ Система дренажа сбросных вод. Дренаж воды из туннелей в случае разрыва трубопровода	Смагуся	Листм
					1 1UQZ Drain water removal system. Water removal from tunnels in case of pipeline break	Phase	Sheet
					План разбивки трубопроводов PUQ10BR001, PUQ10BR002, PUQ20BR001, PUQ20BR002 на блоки Block division plan of pipelines PUQ10BR001, PUQ10BR002, PUQ20BR001, PUQ20BR002	WD	3
					Joint-stock Company "Institute Hydroproject" Dedovsk 2009		
					Формат A1		

Лист Sheet	Наименование Description	Примечание Note	Лист Sheet	Наименование Description	Примечание Note	Лист Sheet	Наименование Description	Примечание Note	Лист Sheet	Наименование Description	Примечание Note	
1	Общие данные General data	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	31	Блок PU030BR003MR032 Block PU030BR003MR032	Изм. 2 (Новый) Rev. 2 (New)	63	Блок PU040BR003MR102 Block PU040BR003MR102	Изм. 2 (Новый) Rev. 2 (New)	95	Блок PU040BR004MR177 Block PU040BR004MR177	Изм. 2 (Новый) Rev. 2 (New)	
2	Схема принципиальная Schematic diagram	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	32	Блоки PU030BR003MR033, 042, 044, 048, 050, 052, 054 Blocks PU030BR003MR033, 042, 044, 048, 050, 052, 054	Изм. 2 (Новый) Rev. 2 (New)	64	Блок PU040BR003MR104 Block PU040BR003MR104	Изм. 2 (Новый) Rev. 2 (New)	96	Блок PU040BR004MR178 Block PU040BR004MR178	Изм. 2 (Новый) Rev. 2 (New)	
3	План разбивки трубопроводов PU030BR001, PU030BR002, PU040BR001, PU040BR002 на блоки Block division plan of pipelines PU030BR001, PU030BR002, PU040BR001, PU040BR002	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	33	Блок PU030BR003MR037 Block PU030BR003MR037	Изм. 2 (Новый) Rev. 2 (New)	65	Блок PU040BR003MR106 Block PU040BR003MR106	Изм. 2 (Новый) Rev. 2 (New)	97	Блок PU040BR004MR185 Block PU040BR004MR185	Изм. 2 (Новый) Rev. 2 (New)	
4	План расстановки опор на трубопроводах PU030BR001, PU040BR001 Layout of supports on the pipelines PU030BR001, PU040BR001	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	35	Блок PU030BR003MR043 Block PU030BR003MR043	Изм. 2 (Новый) Rev. 2 (New)	67	Блок PU030BR004MR118 Block PU030BR004MR118	Изм. 2 (Новый) Rev. 2 (New)	99	Блок PU040BR004MR187 Block PU040BR004MR187	Изм. 2 (Новый) Rev. 2 (New)	
5	План разбивки трубопроводов PU030BR003, PU040BR003, PU030BR004, PU040BR004 на блоки Block division plan of pipelines PU030BR003, PU040BR003, PU030BR004, PU040BR004	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	36	Блоки PU030BR003MR045, 046 Blocks PU030BR003MR045, 046	Изм. 2 (Новый) Rev. 2 (New)	68	Блоки PU030BR004MR119, 121, 125, 127, 129, 131 Blocks PU030BR004MR119, 121, 125, 127, 129, 131	Изм. 2 (Новый) Rev. 2 (New)	100	Блок PU040BR004MR189 Block PU040BR004MR189	Изм. 2 (Новый) Rev. 2 (New)	
6	Разрезы 2-2, 3-3 Sections 2-2, 3-3	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	38	Блок PU030BR003MR047 Block PU030BR003MR047	Изм. 2 (Новый) Rev. 2 (New)	69	Блок PU030BR004MR120 Block PU030BR004MR120	Изм. 2 (Новый) Rev. 2 (New)	101	Блок PU040BR004MR191 Block PU040BR004MR191	Изм. 2 (Новый) Rev. 2 (New)	
7	Установка опор трубопроводов Installation of supports of pipelines	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	39	Блок PU030BR003MR051 Block PU030BR003MR051	Изм. 2 (Новый) Rev. 2 (New)	71	Блок PU030BR004MR124 Block PU030BR004MR124	Изм. 2 (Новый) Rev. 2 (New)	103	Блок PU040BR004MR195 Block PU040BR004MR195	Изм. 2 (Новый) Rev. 2 (New)	
8	Спецификация блоков трубопроводов PU030BR003, PU040BR003 Specification of pipelines PU030BR003, PU040BR003	Изм. 1; 2 (Зам.) Rev. 1; 2 (Repl.)	40	Блок PU030BR003MR053 Block PU030BR003MR053	Изм. 2 (Новый) Rev. 2 (New)	72	Блок PU030BR004MR126 Block PU030BR004MR126	Изм. 2 (Новый) Rev. 2 (New)	104	Блок PU040BR004MR196 Block PU040BR004MR196	Изм. 2 (Новый) Rev. 2 (New)	
9	Разрезы, сечения, узлы Sections, details	Изм. 2 (Новый) Rev. 2 (New)	41	Блок PU030BR003MR055 Block PU030BR003MR055	Изм. 2 (Новый) Rev. 2 (New)	73	Блок PU030BR004MR128 Block PU030BR004MR128	Изм. 2 (Новый) Rev. 2 (New)	105	Блок PU040BR004MR198 Block PU040BR004MR198	Изм. 2 (Новый) Rev. 2 (New)	
10	Спецификация блоков трубопроводов PU030BR004, PU040BR004 Specification of pipelines PU030BR004, PU040BR004	Изм. 2 (Новый) Rev. 2 (New)	42	Блок PU040BR003MR057 Block PU040BR003MR057	Изм. 2 (Новый) Rev. 2 (New)	74	Блок PU030BR004MR130 Block PU030BR004MR130	Изм. 2 (Новый) Rev. 2 (New)	106	Блок PU040BR004MR199 Block PU040BR004MR199	Изм. 2 (Новый) Rev. 2 (New)	
11	Блок PU030BR001MR001 Block PU030BR001MR001	Изм. 2 (Новый) Rev. 2 (New)	43	Блок PU040BR003MR058 Block PU040BR003MR058	Изм. 2 (Новый) Rev. 2 (New)	75	Блок PU030BR004MR132 Block PU030BR004MR132	Изм. 2 (Новый) Rev. 2 (New)	107	Блок PU040BR004MR201 Block PU040BR004MR201	Изм. 2 (Новый) Rev. 2 (New)	
12	Блок PU030BR001MR003 Block PU030BR001MR003	Изм. 2 (Новый) Rev. 2 (New)	44	Блоки PU040BR003MR059, 061, 067, 072, 074, 076, 078, 080, Blocks PU040BR003MR059, 061, 067, 072, 074, 076, 078, 080	Изм. 2 (Новый) Rev. 2 (New)	76	Блок PU030BR004MR133 Block PU030BR004MR133	Изм. 2 (Новый) Rev. 2 (New)	ВЕДОМОСТЬ СПЕЦИФИКАЦИИ SPECIFICATION LIST	Лист Sheet	Наименование Description	Примечание Note
13	Блок PU040BR001MR006 Block PU040BR001MR006	Изм. 2 (Новый) Rev. 2 (New)	45	Блок PU040BR003MR060 Block PU040BR003MR060	Изм. 2 (Новый) Rev. 2 (New)	77	Блок PU030BR004MR140 Block PU030BR004MR140	Изм. 2 (Новый) Rev. 2 (New)				
14	Блок PU040BR001MR007 Block PU040BR001MR007	Изм. 2 (Новый) Rev. 2 (New)	46	Блок PU040BR003MR062 Block PU040BR003MR062	Изм. 2 (Новый) Rev. 2 (New)	78	Блоки PU030BR004MR141, 143, 147, 149, 151, 153, 155 Blocks PU030BR004MR141, 143, 147, 149, 151, 153, 155	Изм. 2 (Новый) Rev. 2 (New)				

Обозначение трубопровода	Назначение трубопровода	Положение трубопровода	Рабочие условия трубопровода	Условия эксплуатации	Материал трубопровода	Диаметр и толщина стенок трубопровода	Длина, м	Масса трубопроводов, кг				
								В том числе				
								Общая	Трубопровода	Опор	Арматура	
Пipeline designation	Description of transported matter	Subject to	Pipeline operating conditions	Hydraulic test conditions	Material of pipe wall	Di. and thickness of pipe wall	Length, m	Pipeline weight, kg				
			Pressure, MPa	Temperature, °C	Pressure, MPa	Temperature, °C		Total	Including			
PUQ030BR001			0,6	34	1,0			350,2	297,2	11,8	41,2	
PUQ030BR002			0,3	39	0,6			501	8,9	—	41,2	
PUQ40BR001			0,6	34	1,0		19	219х7	734,0	675,1	17,7	41,2
PUQ40BR002			0,3	39	0,6			501	8,9	—	41,2	
PUQ40BR003								771,2	719,9	2,1	51,2	
PUQ40BR003								571,4	515,9	4,3	51,2	
PUQ40BR004							19	1460,0	1297,3	10,3	152,4	
PUQ40BR004								1483,2	1316,4	14,4	152,4	

МЕТОДЫ И ОБЪЕМЫ КОНТРОЛЯ СВАРНЫХ СОЕДИНЕНИЙ		METHODS AND DEGREE OF INSPECTION OF WELDED JOINTS	
Тип сварного соединения или категории сварных соединений Category of welded joints or category of welded joints	Наименование типов сварных соединений Name of types of welded parts	Объем контроля Degree of inspection	Разрушающий контроль Destructive test
ПУЭ30R00R01	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ30R00R02	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ30R00R01	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ40R00R02	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ30R00R03	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ40R00R03	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ30R00R04	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-
ПУЭ40R00R04	Сварные швы, соединения или категории сварных соединений Welded joints or category of welded joints	100	-

Название Element	Величина Value	Примечание Note
1 Кальций, мг/л Calcium, mg/l	360...420	
2 Магний, мг/л Magnesium, mg/l	1248...1322	
3 Натрий, мг/л Sodium, mg/l	7500...8500	
4 Калий, мг/л Potassium, mg/l	398...415	
5 Гидрокарбонаты, мг/л Hydrocarbonates, mg/l	73,2...109,8	
6 Карбонаты, мг/л Carbonates, mg/l	67,2...76,8	
7 Сульфаты, мг/л Sulfates, mg/l	2709...2761	
8 Хлориды, мг/л Chlorides, mg/l	19300	
9 Общее содержание, % General salt content, %	3,6	
10 Жесткость (CaCl <sub>2</sub> ), мг/л Water hardness, mg/l	6500	
11 Водородный показатель pH pH value	8	
12 Нерастворимые вещества, мг/л Insoluble matters, mg/l	20	
13 Биологические данные, мг/100 л Biological assay data/mg/100 l	70	

	Граница проектирования Design boundary
	Переход Adapter
	Спуск воды из трубопровода Water discharge from pipeline
	Соединение трубопроводов Connection of pipelines
	Соединение трубопроводов отсутствует No connection of pipelines
	Порядковый номер скользящей опоры Sequence number of sliding support
	Порядковый номер неподвижной опоры Sequence number of fixed support
	Порядковый номер блока трубопровода Sequence number of pipeline block
	Направление движения среды Medium motion direction
	Рукав напорный Delivery hose
	Кран шаровый для КИП Globe valve for instrumentation and control
	Запорная дискная Disk valve
	Запорный обратный Check valve
	Параметры системы (уровень воды в приемнике) System parameter (water level in the pit)

соответствии с основными положениями действующей документации.

соответствии с нормами, правилами и стандартами Российской Федерации.

1 The working drawings have been developed in accordance with basic provisions of the Contract No 77-255/16200 on elaboration of working documentation.

2 The working drawings have been developed in accordance with codes, regulations and standards of the Russian Federation.

3 Classification of pipelines:

- employing pipelines PEB (DN 200);
- 2N0 as per NP -001-97 (PNAE G-01-011-97) "General regulations on safety assurance at Nuclear power plants", PEB - 88/97;
- group B as per PNAE G-5-008-87 "Regulations on arrangement and safe operation of equipment and pipelines at Nuclear power plants";
- pipelines for drainage of tunnels (DN 80) and pipelines for dry-out of tunnels (DN 150);
- 4N as per NP-001-97 (PNAE G-01-011-97) "General regulations on safety assurance at Nuclear power plants", PEB - 88/97;
- group B, category V as per SN 527-80 "Instruction on designing of steel technological pipelines by up to 10 MPa;
- seismic stability category as per PNAE G-5-006-87 "Codes for designing seismic resistant Nuclear power plants";
- I for employing pipelines PEB;
- III for pipelines of drainage and dry-out of tunnels.

4 Thickness of pipes is accepted rating the internal pressure of water considering increase of pipe wall thickness to pipe walls corrosion value during the whole period of operation.

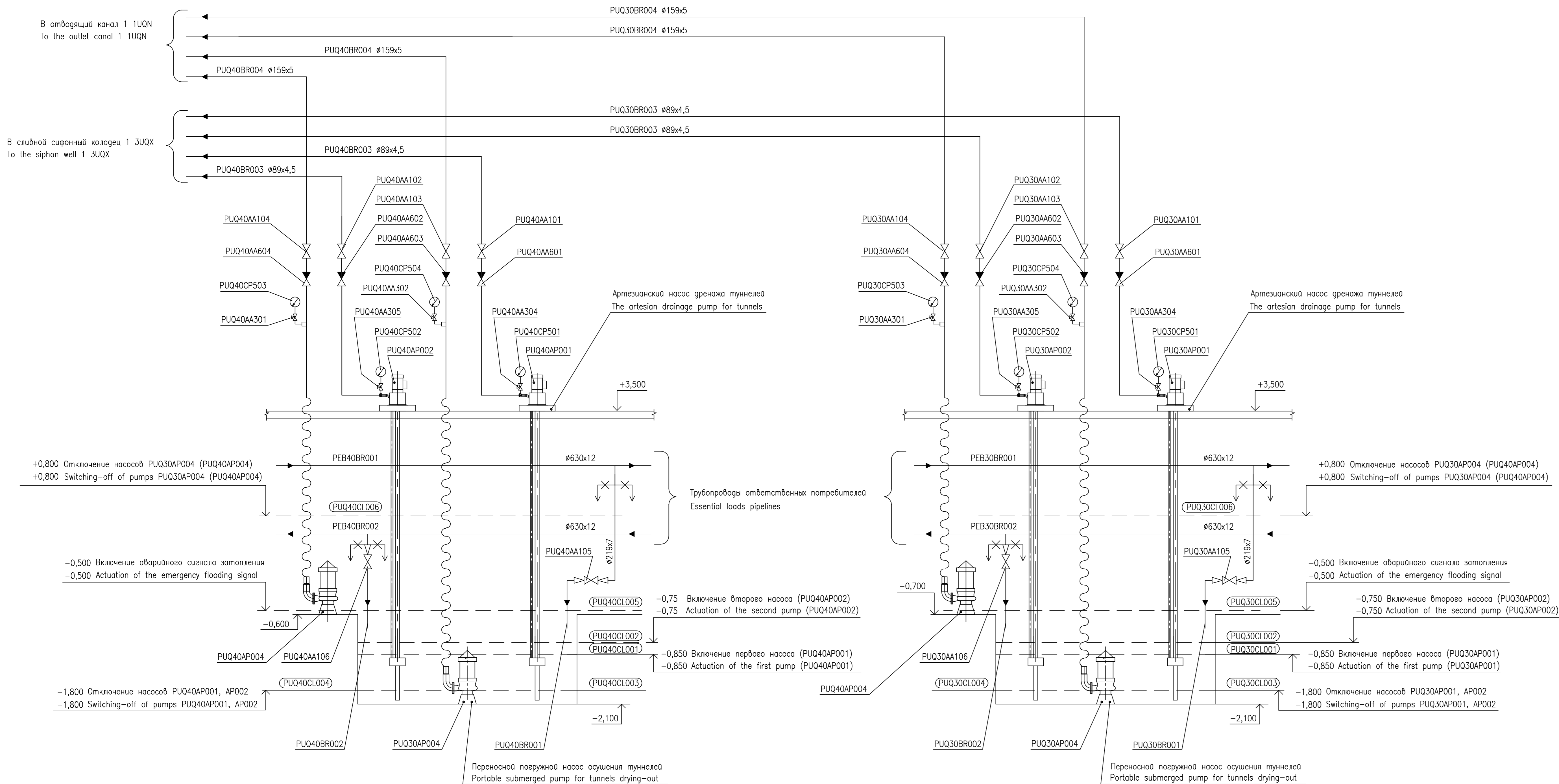
5 Pipelines PEB employing is to be executed through drain units that should be placed in lower points of pipelines and imply water discharge to the drainage pits in the tunnels.

Drainage units diameter is accepted due to pipelines gravity emptying within two hours.

Employing pipelines PEB are to be laid out in tunnels 1.20Z on the slope towards water discharge into the pits. Pipelines gradient is determined by the tunnel floor slope.

6 Tunnels drainage and water discharge at emptying of PEB pipelines into the siphon well 1.30UX is carried out by artesian pumps, suction tubes of which are placed in the drainage pits.

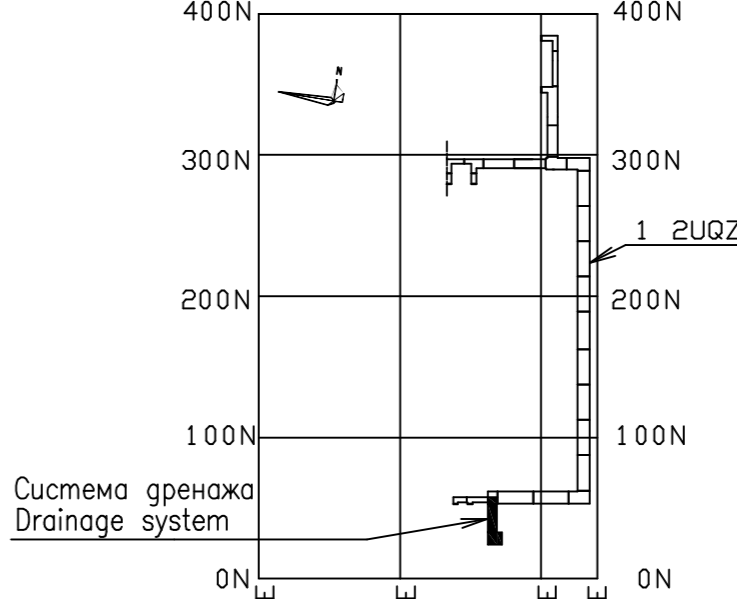
СХЕМА ПРИНЦИПИАЛЬНАЯ  
SCHEMATIC DIAGRAM



ПЕРЕЧЕНЬ ЭЛЕМЕНТОВ  
LIST OF ELEMENTS

Поз. по СЗС	Код по системе ККС	Наименование	Кол.	Примечание	Поз. по СЗС	Код по системе ККС	Наименование	Кол.	Примечание
Item as per specification of buildings and compartments	Code as per KKS	Name	Quant.	Note	Item as per specification of buildings and compartments	Code as per KKS	Name	Quant.	Note
110.8.2.1	PUQ30CP503 PUQ30CP504 PUQ40CP503 PUQ40CP504	Мановакуумметр показывающий МТК-1054-(-0,1...+0,9) МПа 1,5 combined pressure-and-vacuum gage indicating МТК-1054-(-0,1...+0,9) МПа 1,5	4		40.2.3	PUQ30AP001 PUQ30AP002 PUQ40AP001 PUQ40AP002	Агрегат насосный артезианского типа ЦБА 20-30/1 Artesian pump unit of type ЦБА 20-30/1	4	Q=20 м³/ч H=0,3 МПа Q=20 m³/h H=0,3 MPa
110.7.29.4	PUQ30AA301 PUQ30AA302 PUQ40AA301 PUQ40AA302	Кран шаровый для КИП ЦКБ М39385-010 Globe valve for instrumentation and control ЦКБ М39385-010	4	DN 10 P 1,0 МПа		PUQ30CP501 PUQ30CP502 PUQ40CP501 PUQ40CP502	Манометр МП3-УТ2-4,0-АЗС-Ф-ОШТ Pressure gauge МП3-УТ2-4,0-АЗС-Ф-ОШТ	4	Комплектно с ЦБА 20-30/1 Complete with ЦБА 20-30/1
110.8.1	PUQ30CL001 PUQ30CL002 PUQ30CL003 PUQ30CL004 PUQ30CL005 PUQ30CL006 PUQ40CL001 PUQ40CL002 PUQ40CL003 PUQ40CL004 PUQ40CL005 PUQ40CL006	Поплавковое реле уровня. Тип LS03/PP/E 932 Float switch. Type LS03/PP/E 932	12			PUQ30AA304 PUQ30AA305 PUQ40AA304 PUQ40AA305	Кран под манометр Pressure gauge valve	4	Комплектно с ЦБА 20-30/1 Complete with ЦБА 20-30/1
					40.2.5	PUQ30AP004 PUQ40AP004	Электронасос погружной марки НПК 180-30-A-M Submerged pump of grade НПК 180-30-A-M	2	Q=180 м³/ч H=0,3 МПа Q=180 m³/h H=0,3 MPa
					110.7.28.1	PUQ30AA103 PUQ30AA104 PUQ30AA105 PUQ30AA106 PUQ40AA103 PUQ40AA104 PUQ40AA105 PUQ40AA106	Затвор дисковый ЦКБ П99200-150 Disk valve ЦКБ П99200-150	8	DN 150 P 1,0 МПа DN 150 P 1,0 MPa
					110.7.28.3	PUQ30AA101 PUQ30AA102 PUQ40AA101 PUQ40AA102	Затвор дисковый ЦКБ П99200-080 Disk valve ЦКБ П99200-080	4	DN 80 P 1,0 МПа DN 80 P 1,0 MPa
					110.7.31	PUQ30AA603 PUQ30AA604 PUQ40AA603 PUQ40AA604	Затвор обратный ЦКБ П44209-150 Check valve ЦКБ П44209-150	4	DN 150 P 1,0 МПа DN 150 P 1,0 MPa
					110.7.31.1	PUQ30AA601 PUQ30AA602 PUQ40AA601 PUQ40AA602	Затвор обратный ЦКБ П44209-080 Check valve ЦКБ П44209-080	4	DN 80 P 1,0 МПа DN 80 P 1,0 MPa

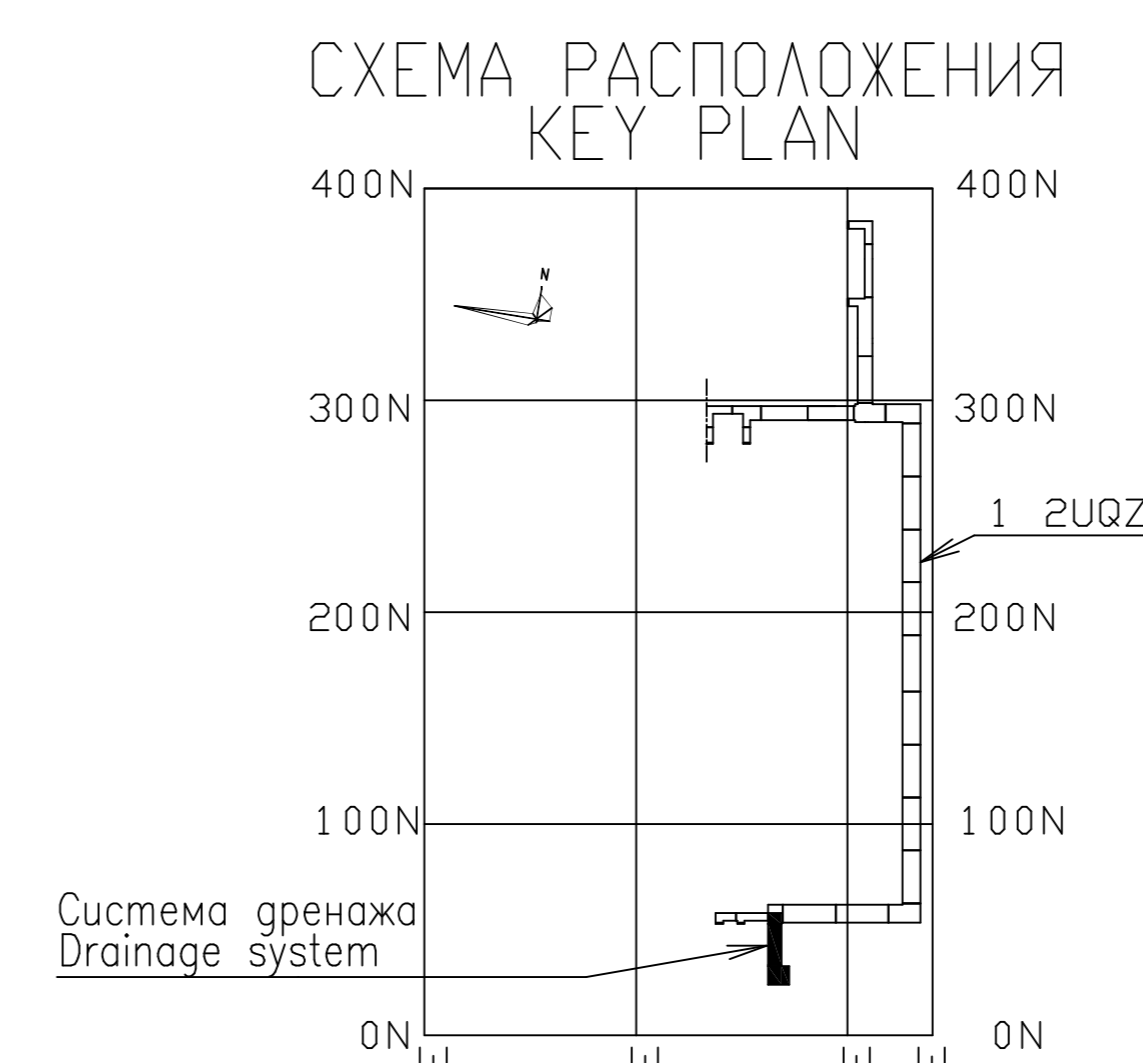
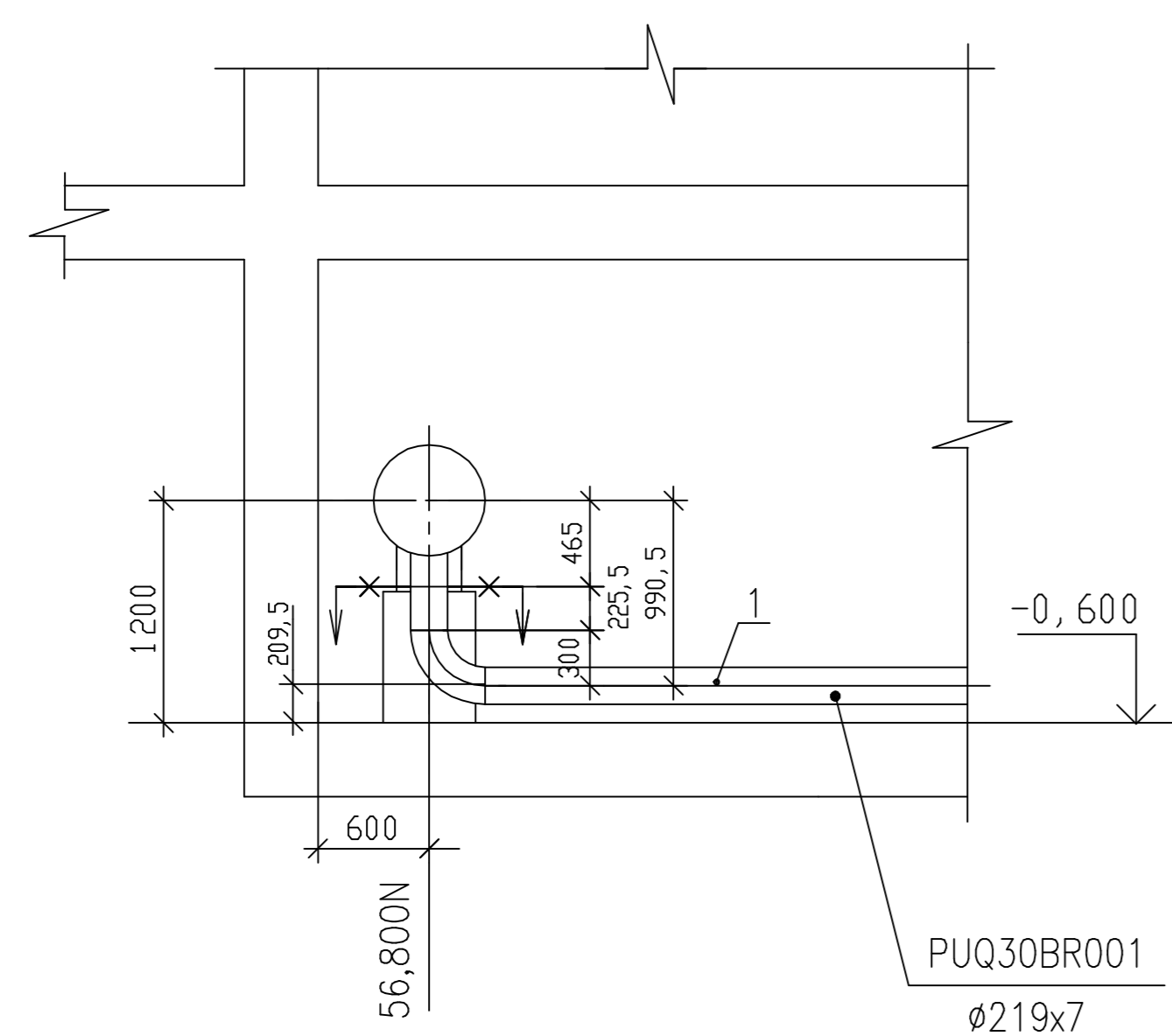
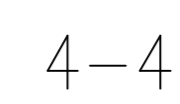
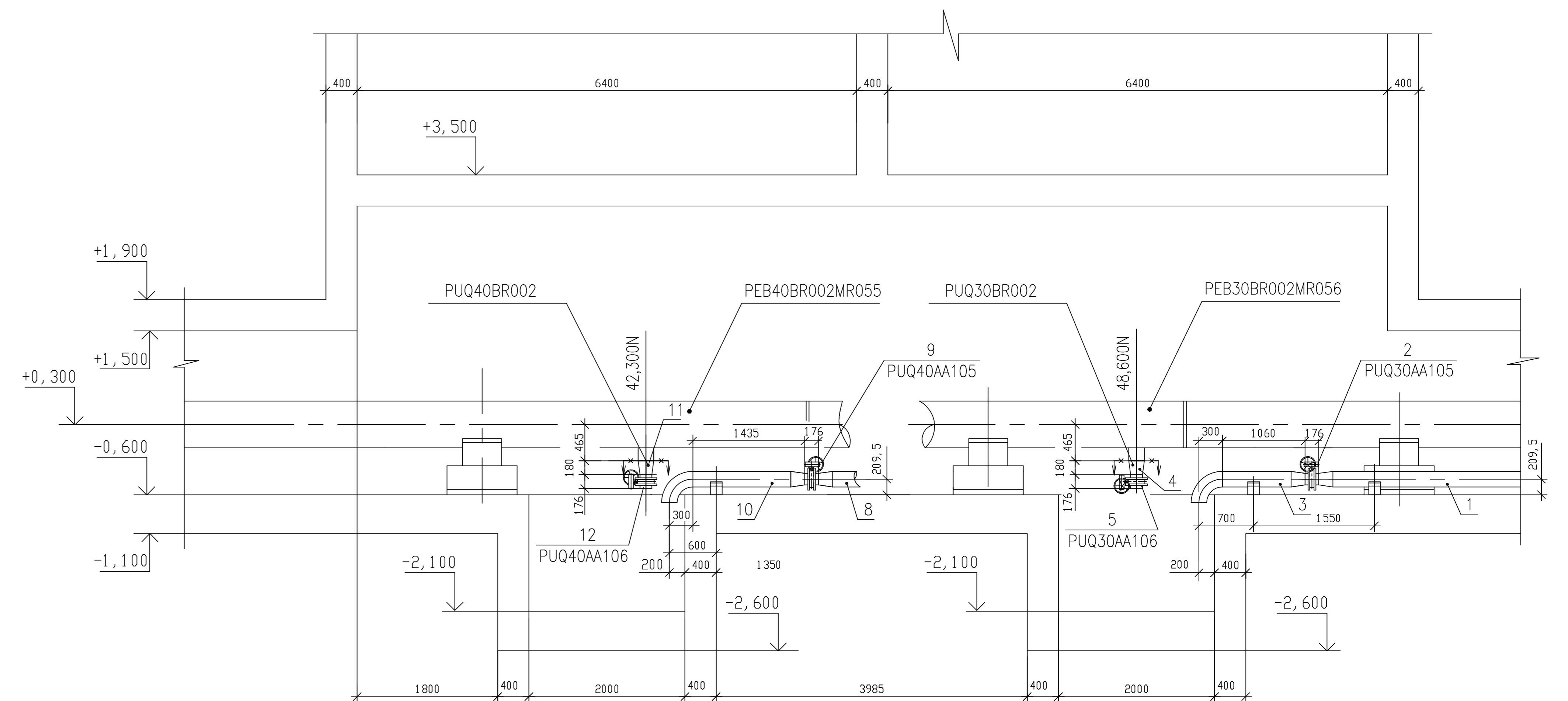
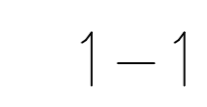
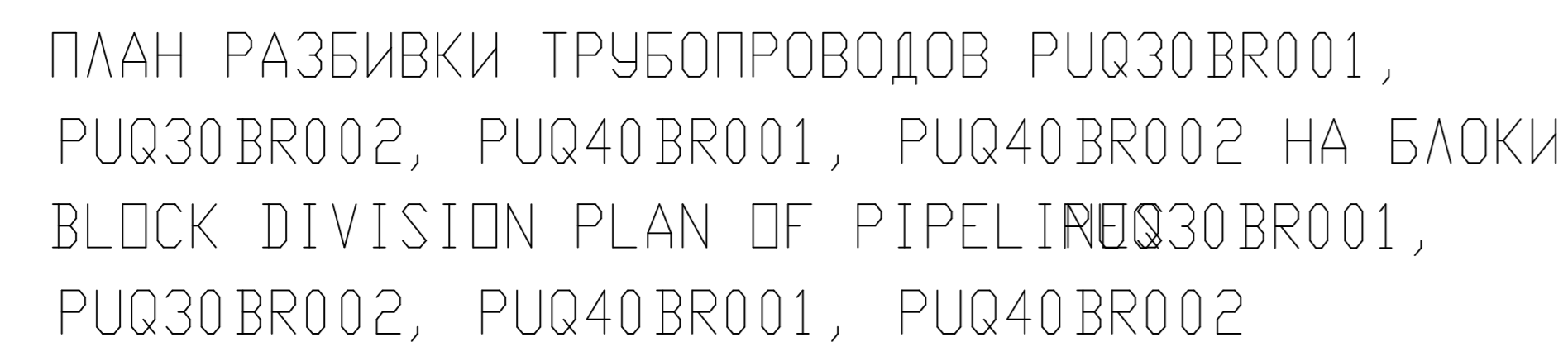
СХЕМА РАСПОЛОЖЕНИЯ  
KEY PLAN



Page No. : 54 of 59

Package Number 1 6 4 11  
File: R37\_KK\_1\_2UQZ\_PUQ\_TW\_OK\_WD001\_02=2.dwg

Данный чертеж не подлежит размножению или передаче другим организациям и лицам без согласия ОАО "Мособлегадропроект"		R37.KK.1_2UQZ.PUQ.TW.OK.WD001		АЭС "КУДАНКУЛАМ" БЛОК 1 NPP "KUDANKULAM" UNIT	
Изм. N уч. Лист N 2UQZ	Получен N 2UQZ	Договор N 2UQZ	Дата 2009	Система дренажа сбросных вод. Дренаж воды из туннелей в случае разрыва трубопровода	1 2UQZ
Rev. N 2UQZ	pat. Sheet	Doc. No. 2UQZ	Signature Date	1 2UQZ	2UQZ
Утвержден Approved	Kondratyev			Drain water removal system. Water removal from tunnels in case of pipeline break	2UQZ
Инспектор H. Kondratyev	А.И.Имова			Схема принципиальная Schematic diagram	
Разработ. Ovrcharenko					
				Лист-модель Sheets	2
				Формат A2x3	



Спецификацию блоков трубопроводов смотри лист 4.

For specification of pipelines blocks see sheet 4.

Page No. : 55 of 59

Package Number 1 6 4 11

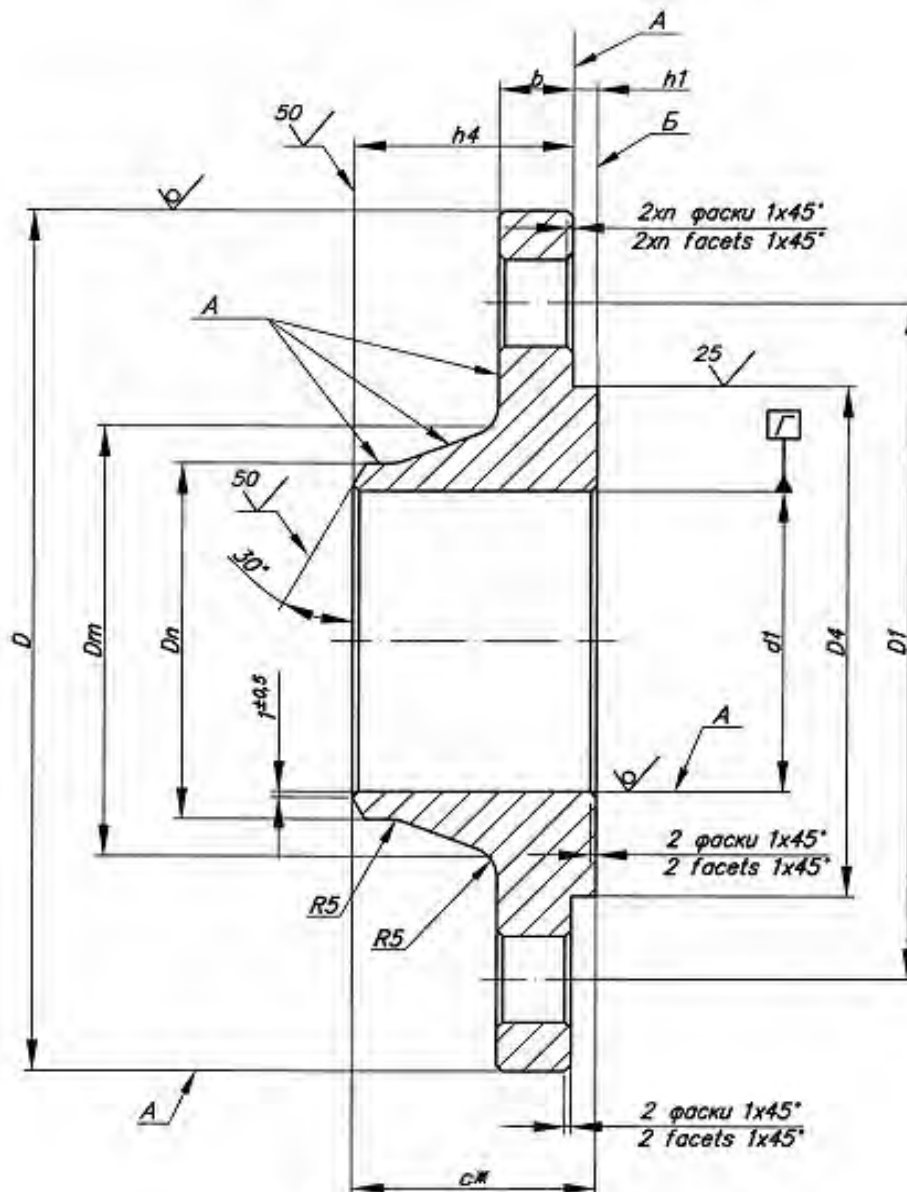
File: R37 KK 1 2UQZ PUQ TW OK WD001\_03=2.dwg

Данный чертёж не подлежит размножению или передаче другим организациям и лицам без согласия  ОАО "Мособлигудропроект"						R37.KK.1 2UQZ.PUQ.TW.OK.WD001					
						АЭС "КУДАНКУЛАМ" NPP "KUDANKULAM"	БЛОК UNIT 1				
	2	—	Repl	30-09							
	Изм.	№ уч.	Лист	№ экз.	Получить	Дата	1 2UQZ	Система дренажа сбросных вод. Дренаж воды из туннелей в случае разрыва трубопровода	Smagua	Lumc	Листов
	Rev. № пат.	Sheet	Doc. No	Signature	Date		1 2UQZ	Drain water removal system. Water removal from tunnels in case of pipeline break	Phase	Sheet	Sheets
	Ymbepayn Approved H. контрп. Inspector Разраб. Designed		Kondratyev		Afimova		Ovcharenko	План разработки трубопровода PUQ30BR001, PUQ30BR002, PUQ40BR001, PUQ40BR002 на блоку PUQ30BR002 Block division plan of pipelines PUQ30BR001 PUQ30BR002, PUQ40BR001, PUQ40BR002	Joint-stock Company "Institute Hydroproject" Delovsk 2009		

формат A1

## Annexure – IV

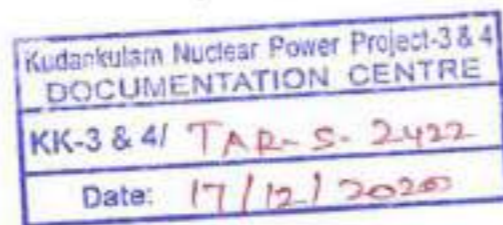
Details of Flange for pipe of dimensions 530 mm X 12 mm



WNRF	d1	b	h4	Dm	Dn	D	D1	D4	d	Bolt holes	h	C*
	501 mm	24 mm	65 mm	550 mm	535 mm	670 mm	620 mm	584.2 mm	32 mm	20 No	5 mm	70 mm

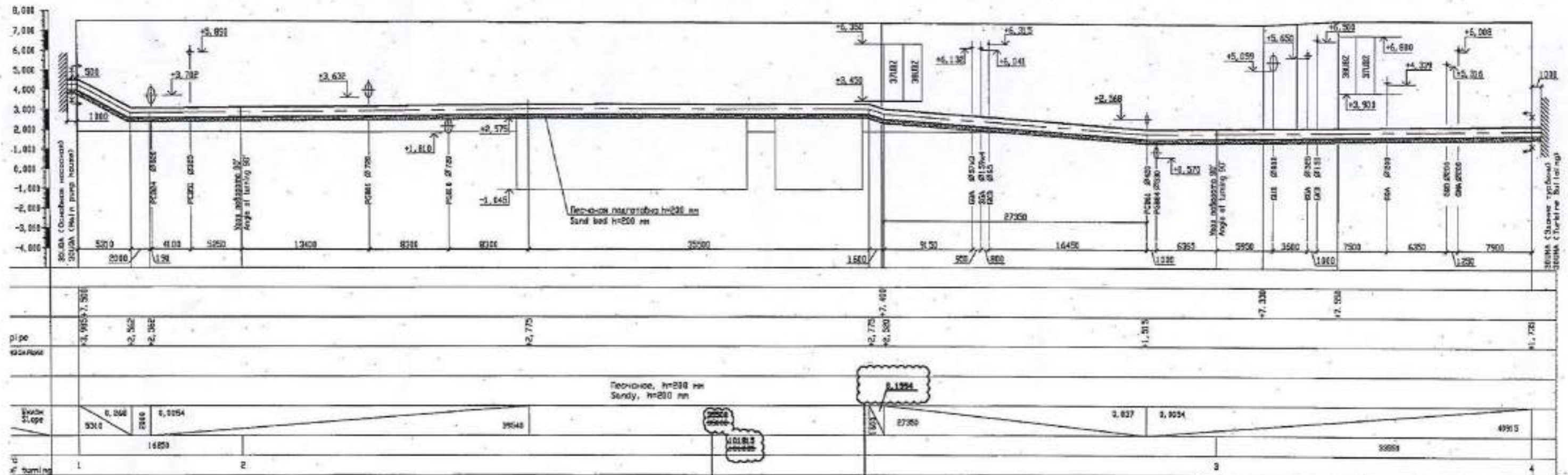
1. Processing of surfaces A with roughness  $Ra \leq 100 \mu m$ .
2. Processing of surfaces b with roughness  $Ra \leq 25 \mu m$  would be supposed at circle the figurative a direction of roughness.
3. It is supposed instead of  $45^\circ$  angle to execute a rounding of R2 (radius 2 mm).
4. \* - The size for inquiries.

ПРОФИЛЬ ТРУБОПРОВОДА 30PGB10  
PROFILE OF PIPELINE 30PGB10

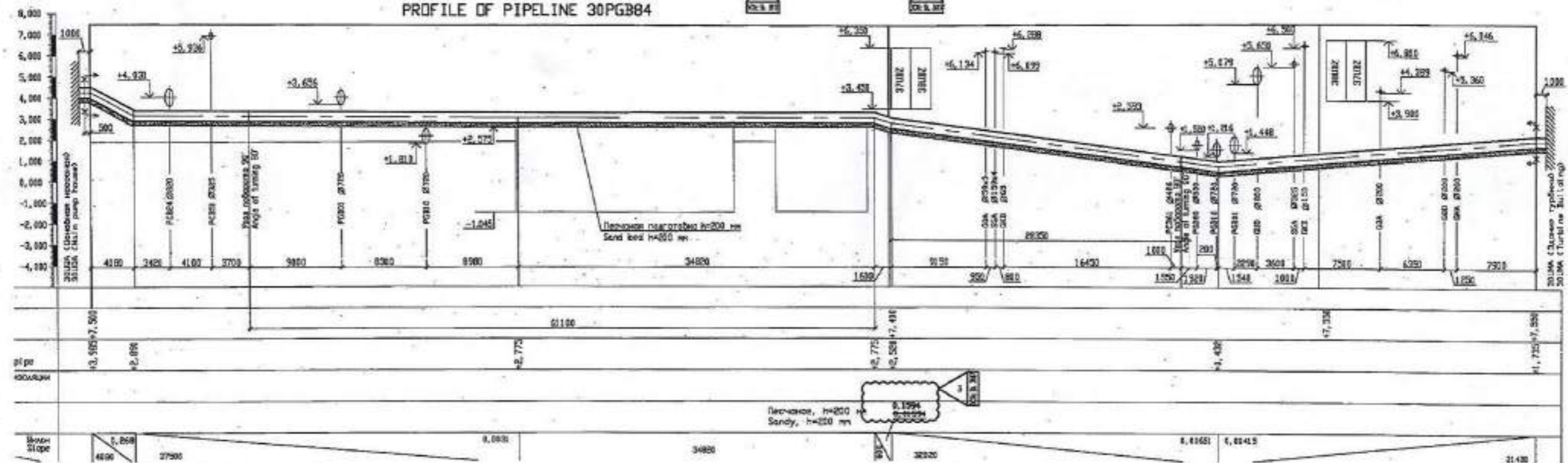


R2B.KK34.3.PCB.TM.OK.WD001 rev. 0	
Sketch 3617	Zheleznyakova
TAR-FEM/203	Ozerov
Sheet 3	Изменения/Changes 2, 3
	Фрагмент/Fragment 2/2

ПРОФИЛЬ ТРУБОПРОВОДА 30РГВ80  
PROFILE OF PIPELINE 30РГВ80



ПРОФИЛЬ ТРУБОПРОВОДА 30РГВ84  
PROFILE OF PIPELINE 30РГВ84



Package Number 3 11 6 20 / 10.12.2020

R28.KK34.3.PGB.TM.OK.WD001 rev. 0

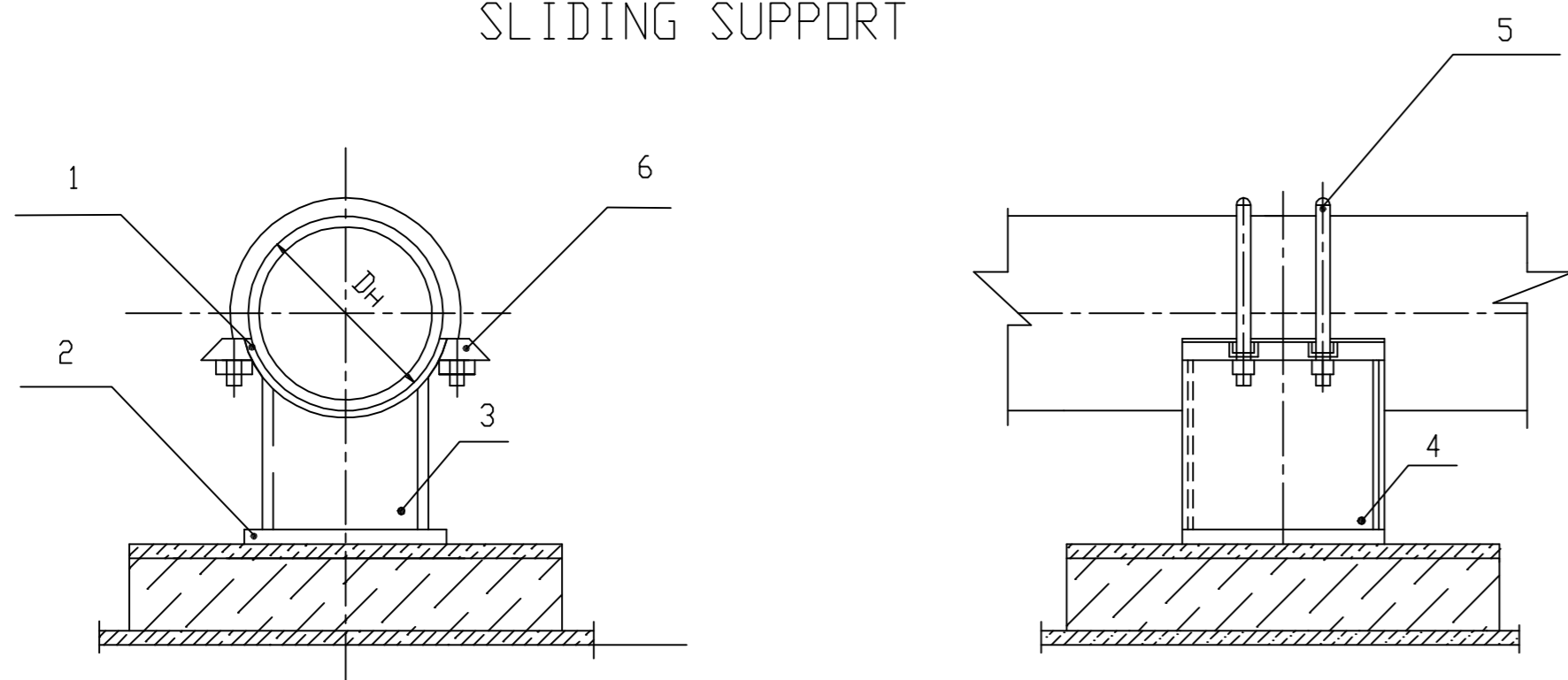
Sketch 3617	Zhalaznyakova	Rev. 0
TAR-FEM/203	Ozerov	
Sheet 4	Изменения/Changes	1, 2
	Фрагмент/Fragment	1/1

Kudankulam Nuclear Power Project-3 & 4  
DOCUMENTATION CENTRE  
KK-3 & 4/ TAR-S-2422  
Date: 17/12/2020

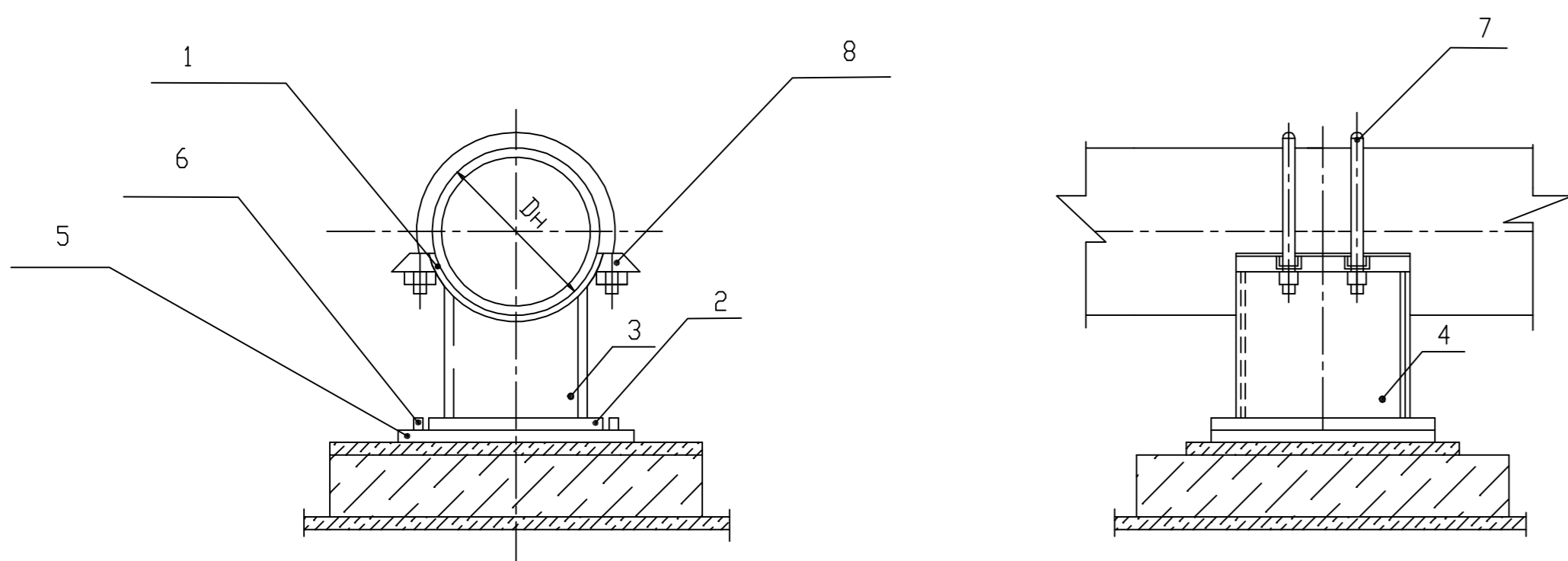
**ANNEXURE-II**  
**DRAWINGS FOR PIPELINE SUPPORTS**

# DRAWINGS FOR PEB PIPELINE SUPPORTS

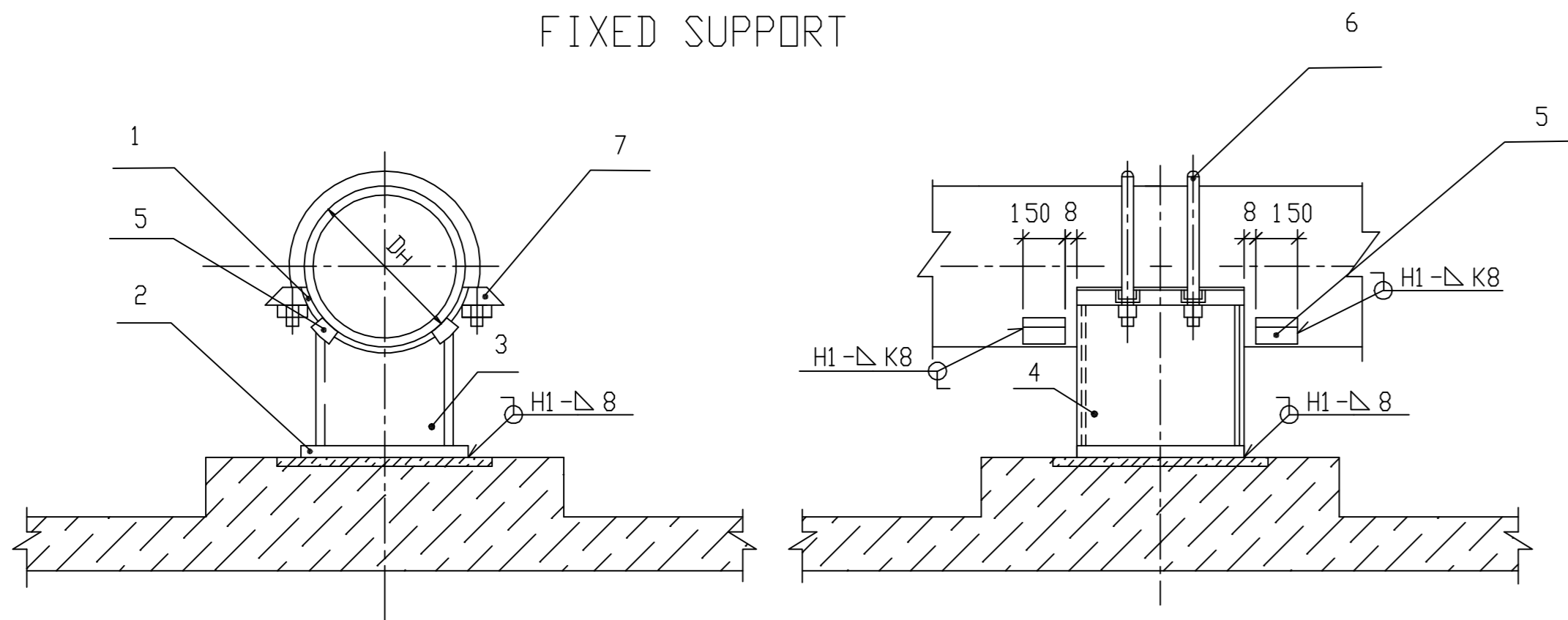
SLIDING SUPPORT



SLIDING GUIDE SUPPORT

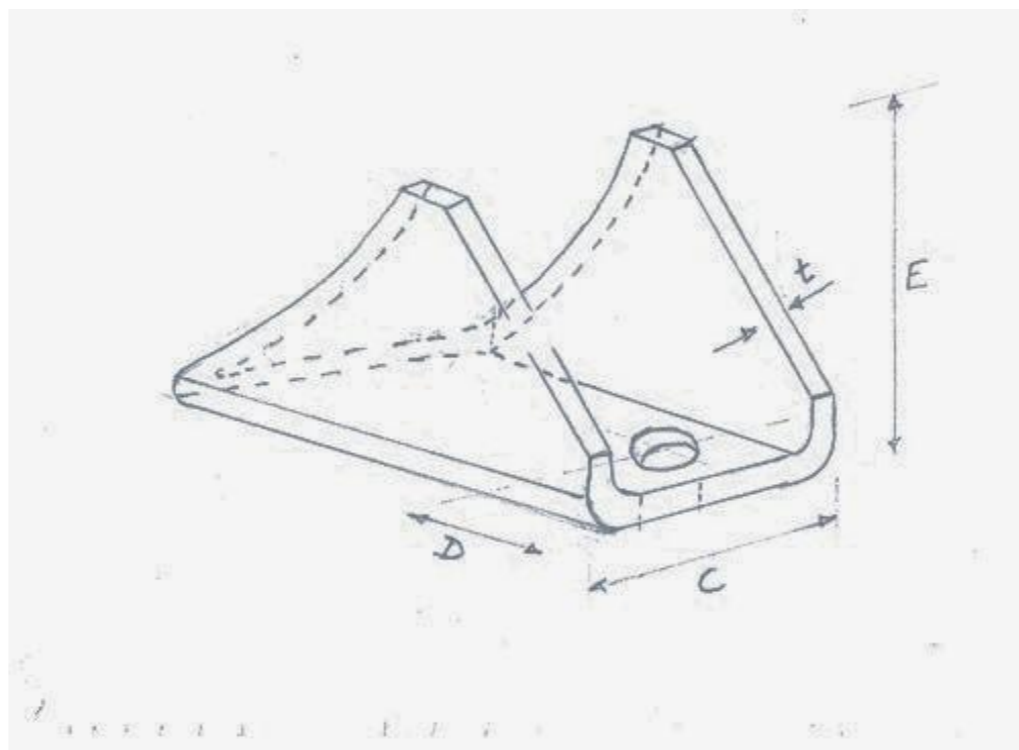


FIXED SUPPORT



## Fastener Bracket

Item No-6 for sliding support  
Item No-7 for fixed support  
Item No-8 for sliding guide support



Details of Fastener's Bracket for pipe supports

Pipe OD	D	C	t	E
406.4	To Suit "U-Bolt" Dimensions	75	10	90
530		75	10	110
630		75	10	140

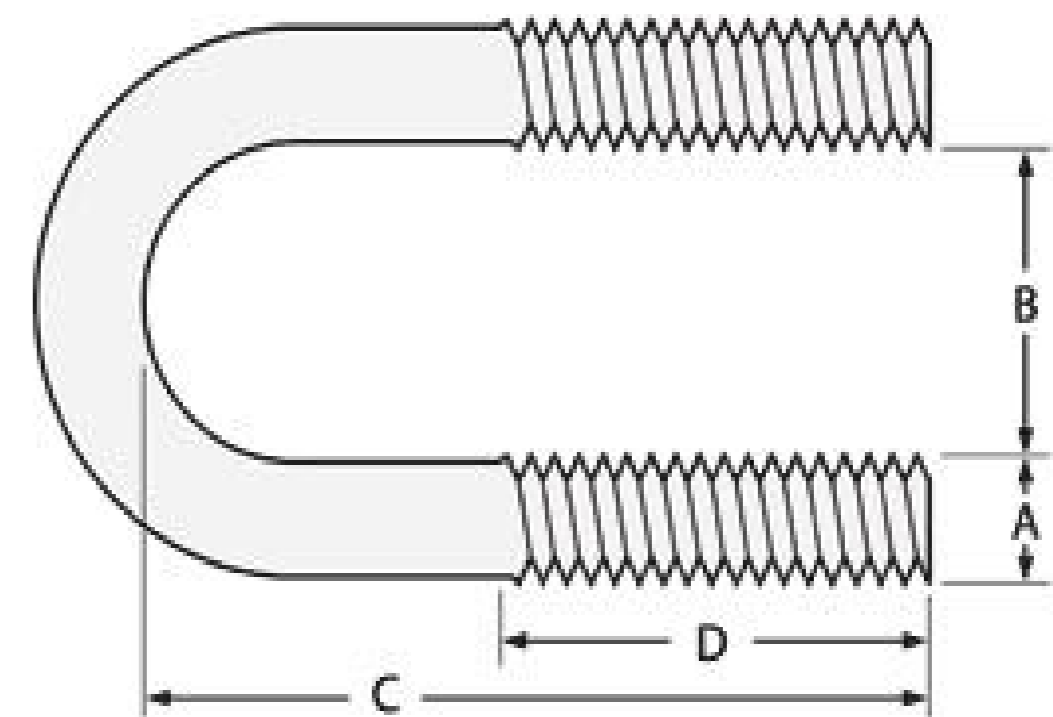
## BILL OF MATERIALS

Bill of Material for Sliding Support (406.4 X 12.70)			
Sr. No.	Description	Quantity	Remarks
1	540 X 200 X 10 Saddle plate	1	Distance between two U-Bolts is 120 mm
2	300 X 200 X 10 Plate	1	
3	280 X 175 X 10 Plate	2	
4	200 X 175 X 10 Plate	2	
5	U BOLTS	2	
6	Fastener's Bracket	4	
7			
8			

Bill of Material for Sliding Guide Support (530 X 12)			
Sr. No.	Description	Quantity	Remarks
1	700 X 250 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	500 X 400 X 10 Plate	1	
3	400 X 125 X 10 Plate	2	
4	500 X 125 X 10 Plate	2	
5	550 x 550 x 10 Plate	1	
6	10 x 10 x 500 Square Rod	2	
7	U BOLTS	2	
8	Fastener's Bracket	4	

Bill of Material for Fixed Support (630 X 12)			
Sr. No.	Description	Quantity	Remarks
1	825 X 500 X 10 Saddle plate	1	Distance between two U-Bolts is 260 mm
2	550 X 550 X 10 Plate	1	
3	500 X 125 X 10 Plate	2	
4	500 X 125 X 10 Plate	2	
5	15 x 20 x 150 Wedge block	2	
6	U BOLTS	2	
7	Fastener's Bracket	4	
8			

## U-Bolt



Details of U-Bolts for pipe supports				
Pipe OD	A	B	C	D
406.4	28	410	350	125
530	32	540	450	150
630	36	640	510	150

Bill of Material for Sliding Guide Support (406.4 X 12.70)			
Sr. No.	Description	Quantity	Remarks
1	540 X 200 X 10 Saddle plate	1	Distance between two U-Bolts is 120 mm
2	300 X 200 X 10 Plate	1	
3	280 X 175 X 10 Plate	2	
4	200 X 175 X 10 Plate	2	
5	350 x 300 x 10 Plate	1	
6	10 x 10 x 300 Square Rod	2	
7	U BOLTS	2	
8	Fastener's Bracket	4	

Bill of Material for Sliding Support (530 X 12)			
Sr. No.	Description	Quantity	Remarks
1	700 X 250 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	400 X 250 X 10 Plate	1	
3	400 X 125 X 10 Plate	2	
4	250 X 125 X 10 Plate	2	
5	U BOLTS	2	
6	Fastener's Bracket	4	
7			
8			

Bill of Material for Sliding Support (630 X 12) Type-I			
Sr. No.	Description	Quantity	Remarks
1	825 X 250 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	500 X 250 X 10 Base plate	1	
3	500 X 125 X 10 Plate	2	
4	250 X 125 X 10 Plate	2	
5	U BOLTS	2	
6	Fastener's Bracket	4	
7			
8			

Bill of Material for Sliding Support (630 X 12) Type-II			
Sr. No.	Description	Quantity	Remarks
1	825 X 250 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	500 X 250 X 10 Plate	1	
3	500 X 175 X 10 Plate	2	
4	250 X 175 X 10 Plate	2	
5	U BOLTS	2	
6	Fastener's Bracket	4	
7			
8			

Bill of Material for Sliding Guide Support (630 X 12) Type-I			
Sr. No.	Description	Quantity	Remarks
1	825 X 500 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	550 X 250 X 10 Plate	1	
3	500 X 125 X 10 Plate	2	
4	250 X 125 X 10 Plate	2	
5	600 x 300 x 10 Plate	1	
6	10 x 10 x 500 Square Rod	2	
7	U BOLTS	2	
8	Fastener's Bracket	4	

Bill of Material for Sliding Guide Support (630 X 12) Type-II			
Sr. No.	Description	Quantity	Remarks
1	825 X 500 X 10 Saddle plate	1	Distance between two U-Bolts is 150 mm
2	550 X 250 X 10 Plate	1	
3	500 X 175 X 10 Plate	2	
4	250 X 175 X 10 Plate	2	
5	600 x 300 x 10 Plate	1	
6	10 x 10 x 500 Square Rod	2	
7	U BOLTS	2	
8	Fastener's Bracket	4	

### Note:

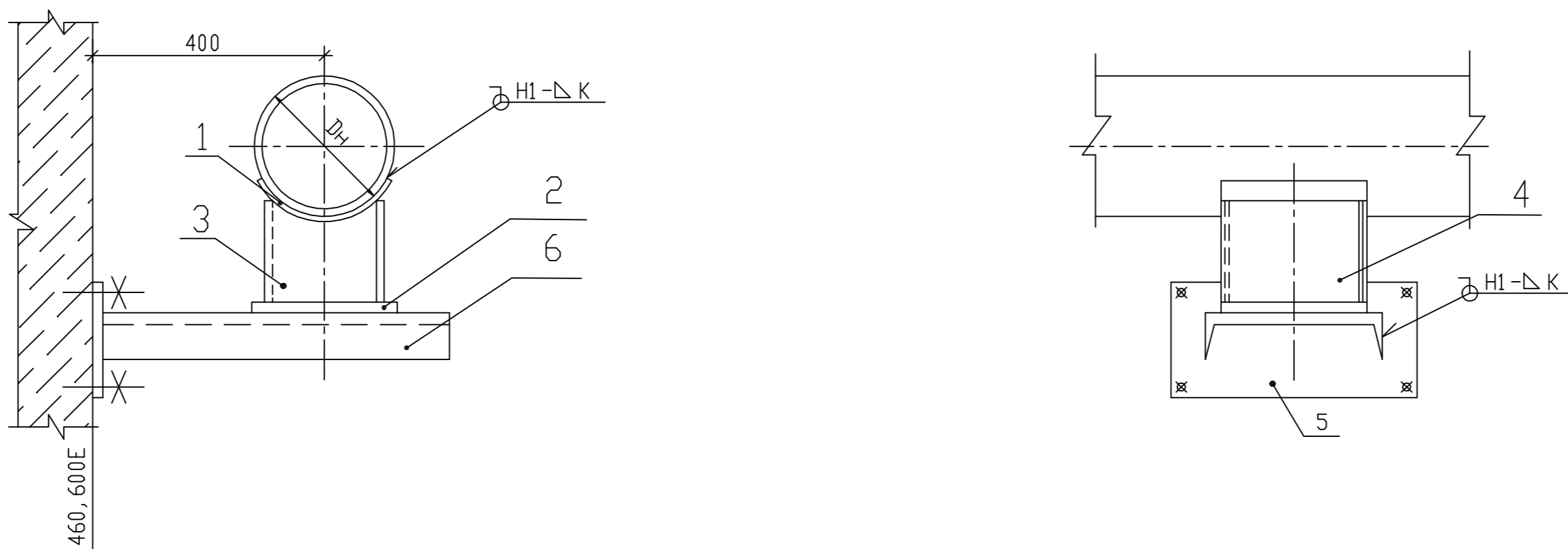
- 1) All Dimensions are in mm.
- 2) The contractor shall prepare his fabrication drawings for approval.
- 3) The measurements shown is only indicative and for reference only. Contractor shall design and prepare drawing for fabrication for approval from NPCIL.

DRAWINGS FOR PUQ PIPELINE SUPPORTS

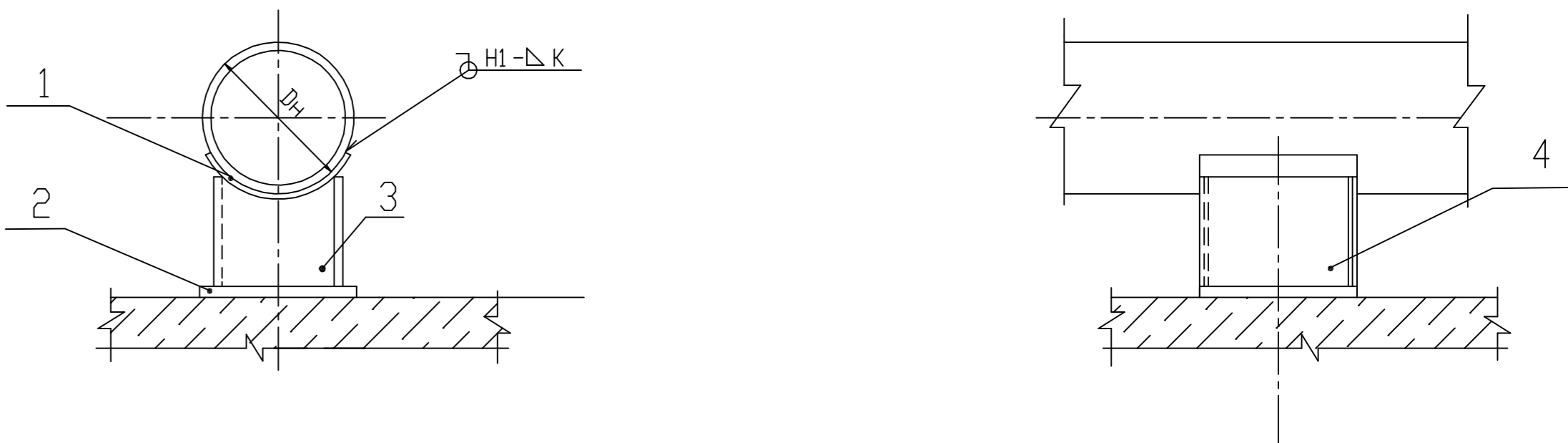
SLIDING SUPPORT FOR 219 X 7.03



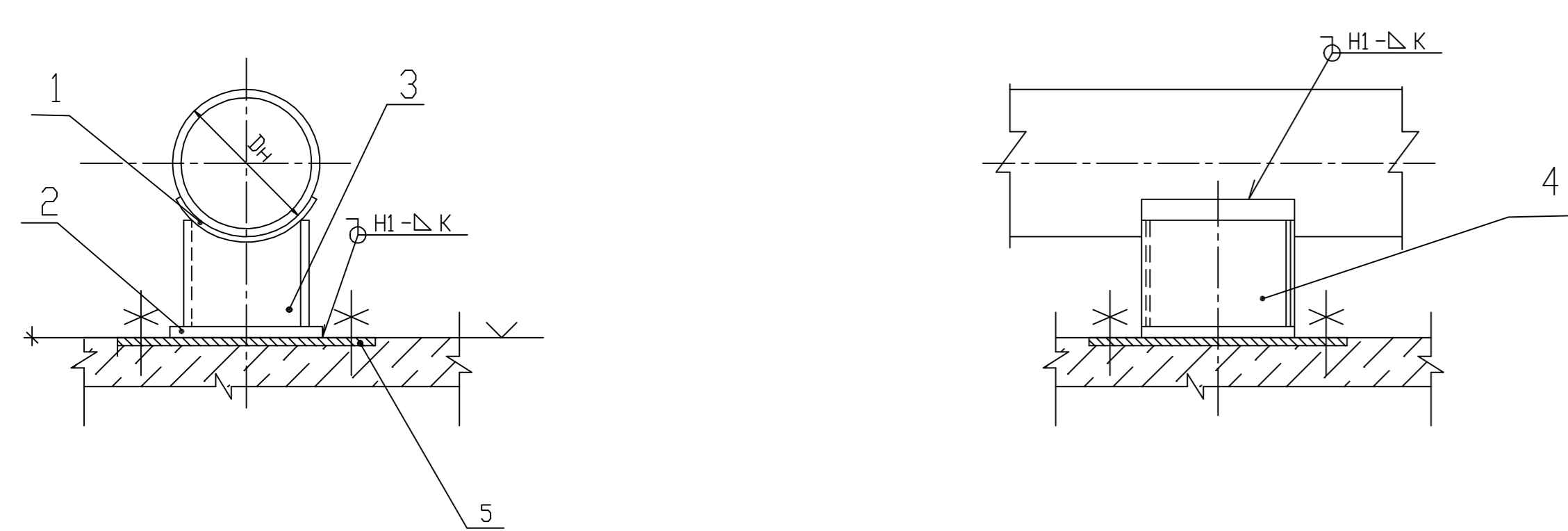
SLIDING SUPPORT FOR 88.9 X 5.49



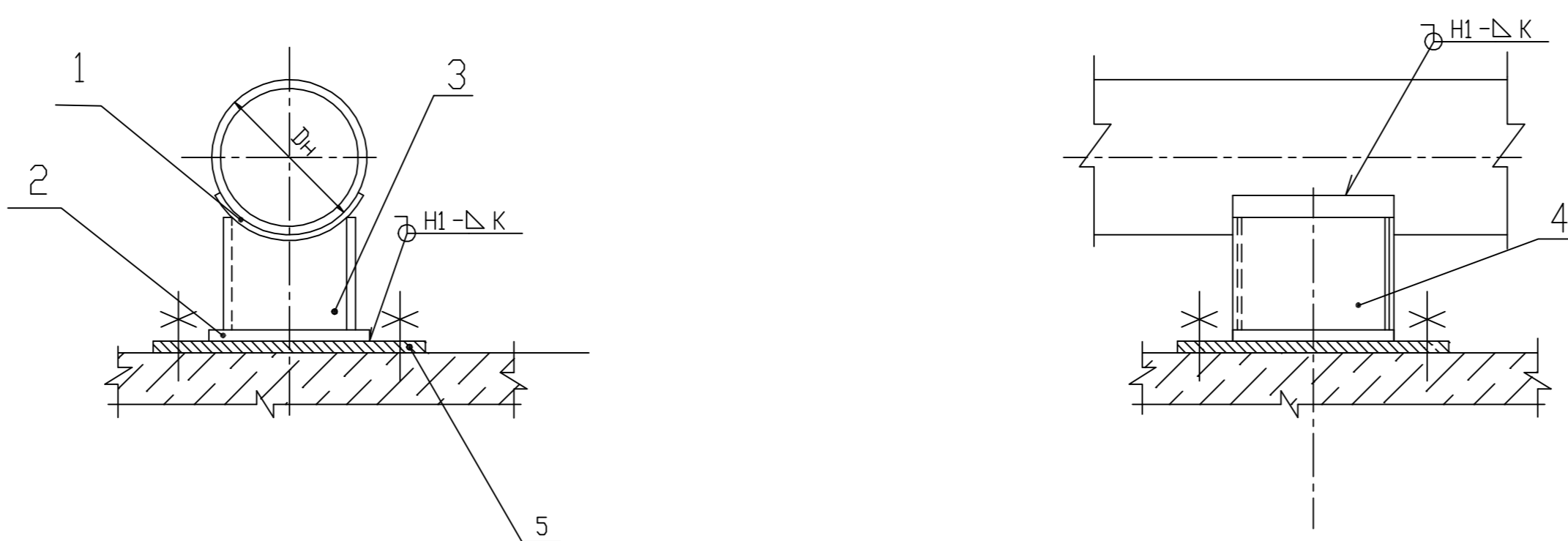
TYPE-I SLIDING SUPPORT FOR 168.3 X 7.11



FIXED SUPPORT FOR 219 X 7.03



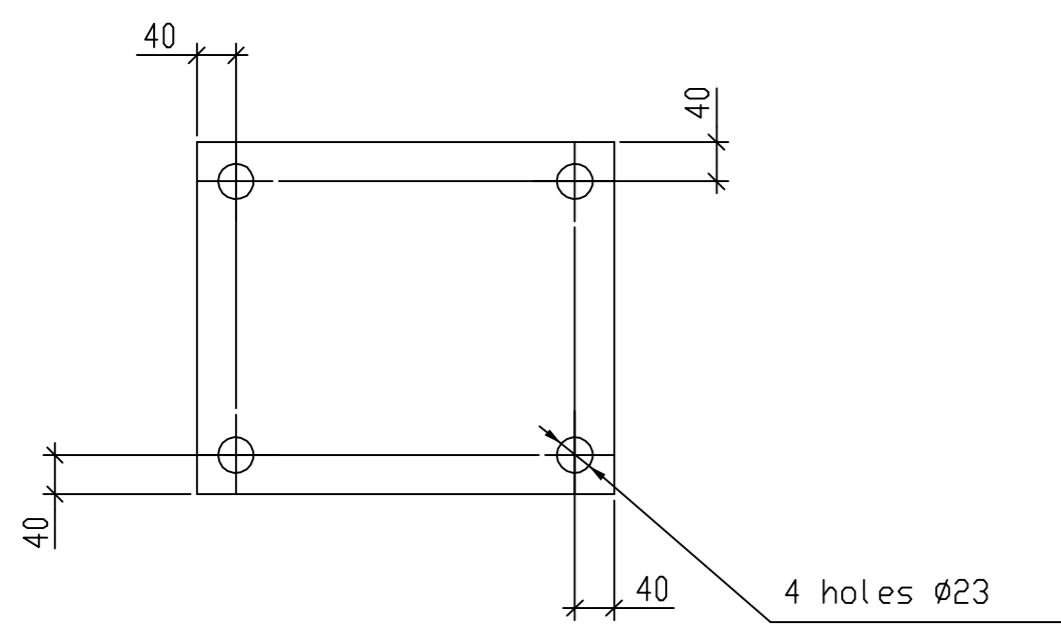
FIXED SUPPORT FOR 88.9 X 5.49



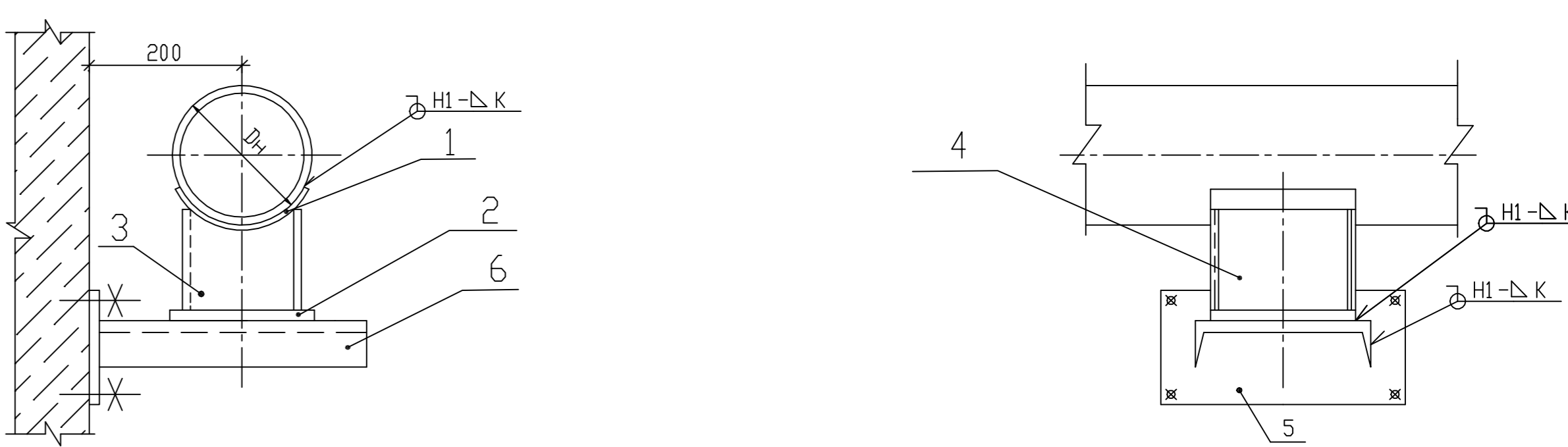
TYPE-II SLIDING SUPPORT FOR 168.3 X 7.11



BASE PLATE



FIXED SUPPORT FOR 168.3 X 7.11



BILL OF MATERIAL

Details of Sliding support (219 X 7.03)			
Sr. No.	Description	Quantity	Remarks
1	230 x 200 x 6 Saddle Plate	1	
2	200 x 200 x 8 Plate	1	
3	180 x 125 x 8 Plate	2	
4	200 x 125 x 8 Plate	2	
5			
6			

Details of Fixed support (219 X 7.03)			
Sr. No.	Description	Quantity	Remarks
1	230 x 200 x 6 Saddle Plate	1	
2	200 x 200 x 8 Plate	1	
3	180 x 200 x 8 Plate	2	
4	200 x 200 x 8 Plate	2	
5	350 x 350 x 10 Plate	1	
6			

Details of Sliding support (88.9 X 5.49)			
Sr. No.	Description	Quantity	Remarks
1	100 x 100 x 6 Saddle Plate	1	
2	60 x 100 x 8 Plate	1	
3	100 x 125 x 8 Plate	2	
4	600 x 125 x 8 Plate	2	
5	210 x 250 x 10 Plate	1	
6	Channel section 120 x 8 x 600	1	width x thickness x length

Details of Fixed support (88.9 X 5.49)			
Sr. No.	Description	Quantity	Remarks
1	100 x 100 x 6 Saddle Plate	1	
2	60 x 100 x 8 Plate	1	
3	100 x 125 x 8 Plate	2	
4	600 x 125 x 8 Plate	2	
5	210 x 250 x 10 Plate	1	
6			

Details of Type-I Sliding support (168.3 X 7.11)			
Sr. No.	Description	Quantity	Remarks
1	175 x 150 x 6 Saddle Plate	1	
2	120 x 150 x 8 Plate	1	
3	120 x 125 x 8 Plate	2	
4	150 x 125 x 8 Plate	2	
5			
6			

Details of Type-II Sliding support (168.3 X 7.11)			
Sr. No.	Description	Quantity	Remarks
1	175 x 150 x 6 Saddle Plate	1	
2	120 x 150 x 8 Plate	1	
3	120 x 125 x 8 Plate	2	
4	150 x 125 x 8 Plate	2	
5	270 x 300 x 10 Plate	1	
6	Channel section 175 x 8x 400	1	width x thickness x length

Details of Fixed support (168.3 X 7.11)			
Sr. No.	Description	Quantity	Remarks
1	175 x 150 x 6 Saddle Plate	1	
2	120 x 150 x 8 Plate	1	
3	120 x 125 x 8 Plate	2	
4	150 x 125 x 8 Plate	2	
5	270 x 300 x 10 Plate	1	
6	Channel section 175 x 8x 400	1	width x thickness x length

- Note:**
- 1) All Dimensions are in mm.
  - 2) The contractor shall prepare his fabrication drawings for approval.
  - 3) The measurements shown is only indicative and for reference only. Contractor shall design and prepare drawing for fabrication for approval from NPCIL.

**SAMPLE INSPECTION CHAMBER DRAWINGS**

Amesbury - B  
Sh: 1/3

R.c.c. detail of cover slab

Cover

Slab

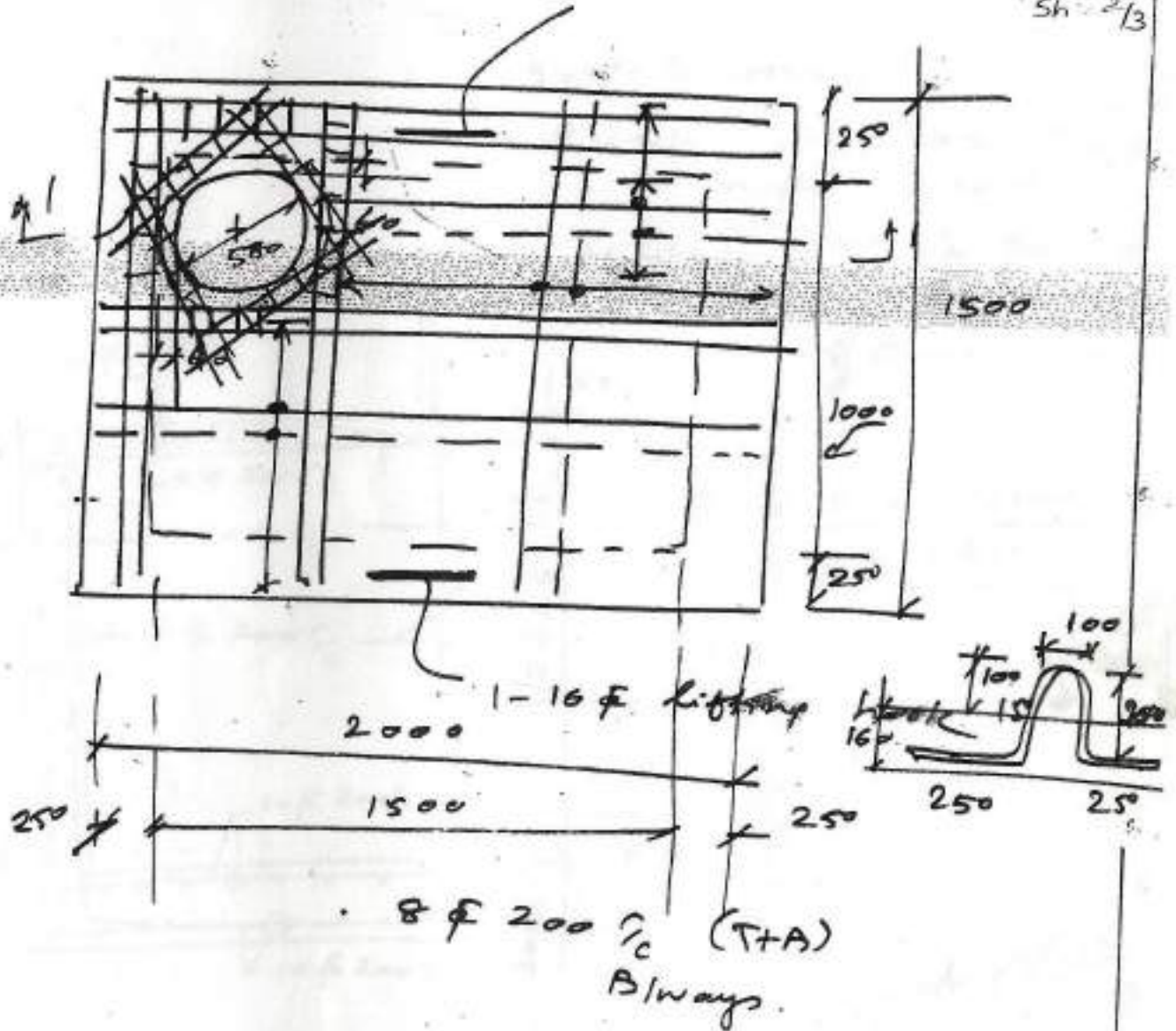
t: 160 mm

M30, fy 415

1-PCB 34, 2 PCB 34

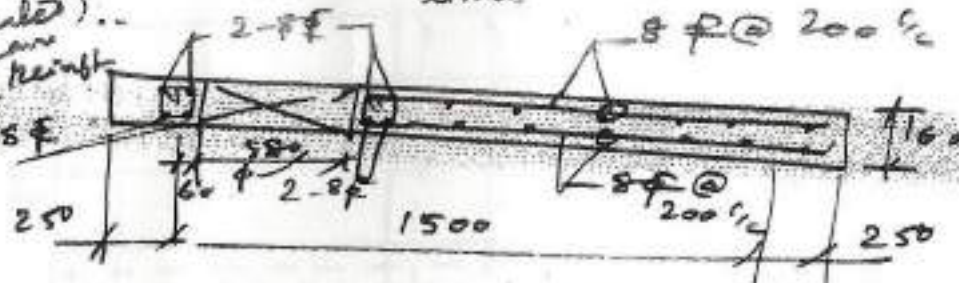
1-16 $\phi$  lifting hook

Sh-2/3



Shear Reinft 8 $\phi$  100 c/c  
links

concrete) ..  
beam  
extra Reinf



Precast  
slab

1-1

Balaigh  
25.9.07

1- PCB 34

2 PCB 34

(Acad) Inspection well

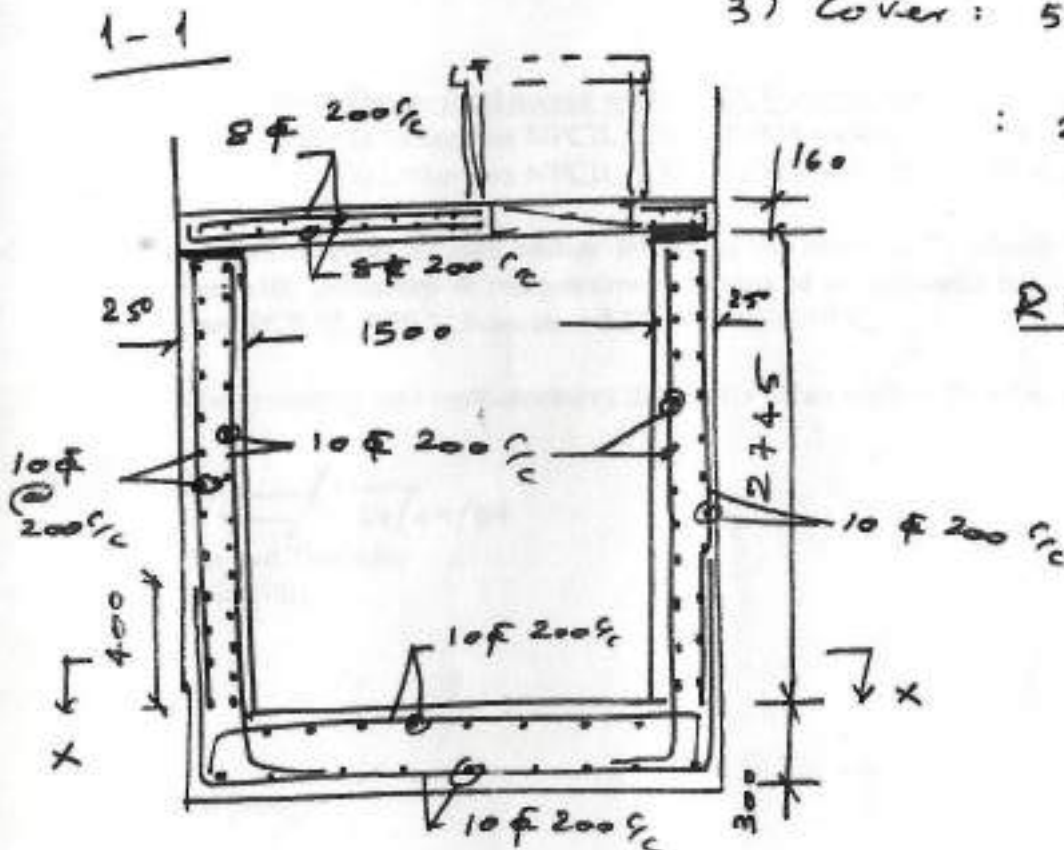
(Reinforcement Detail)

Notes.

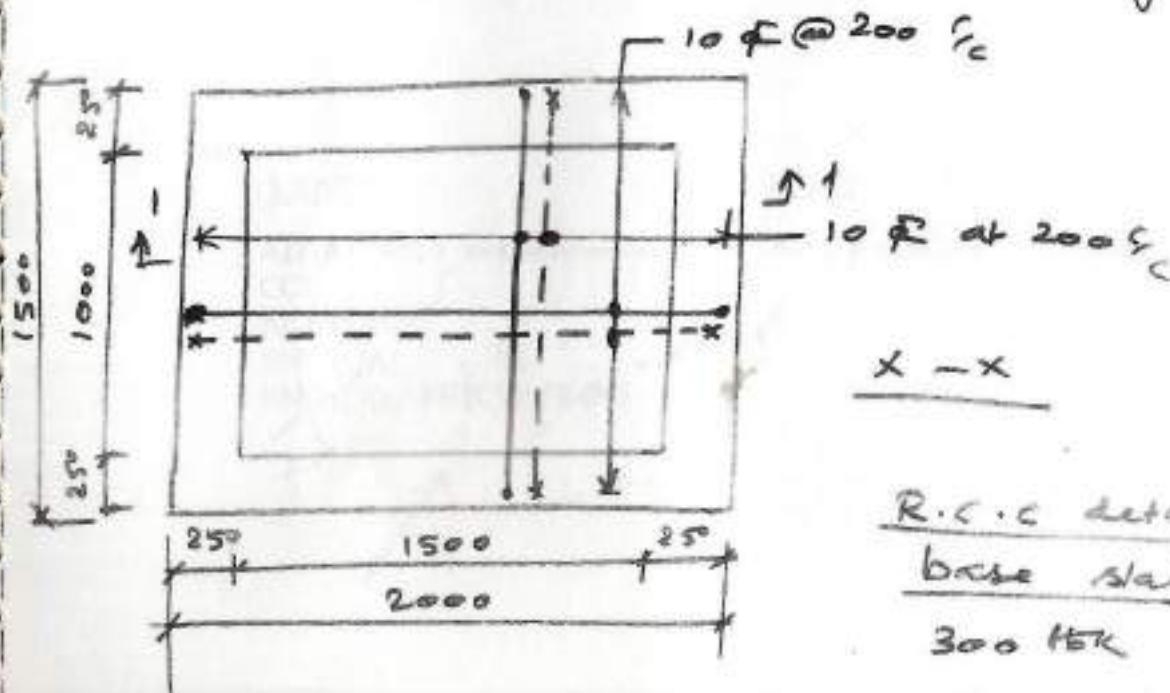
- 1) grade of concrete : M30 (13.456)
- 2) Reinf: HYSD bars -  $F_y 415$  as per IS-1786

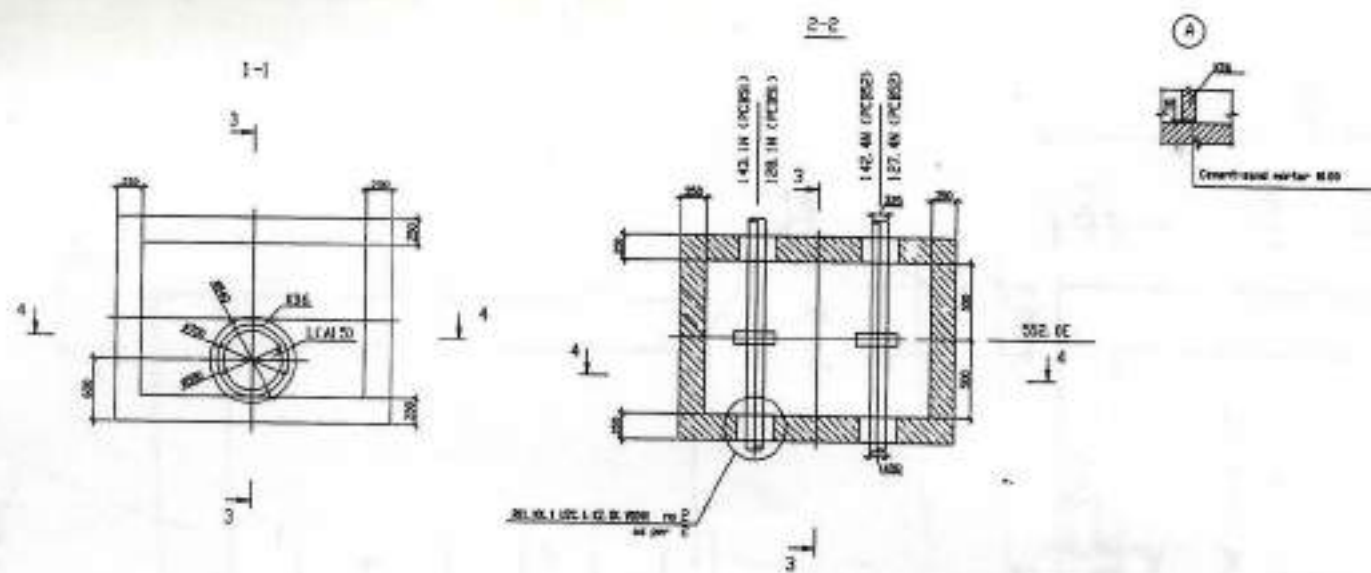
- 3) Cover: 50mm for Base raft and walls

: 25mm for cover slab.

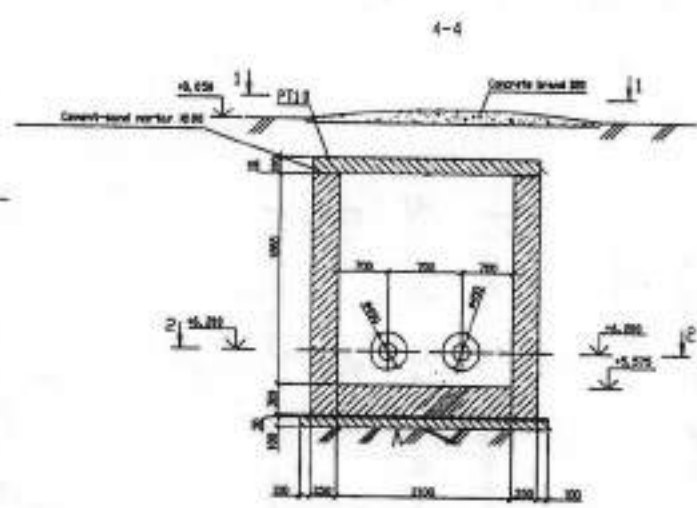
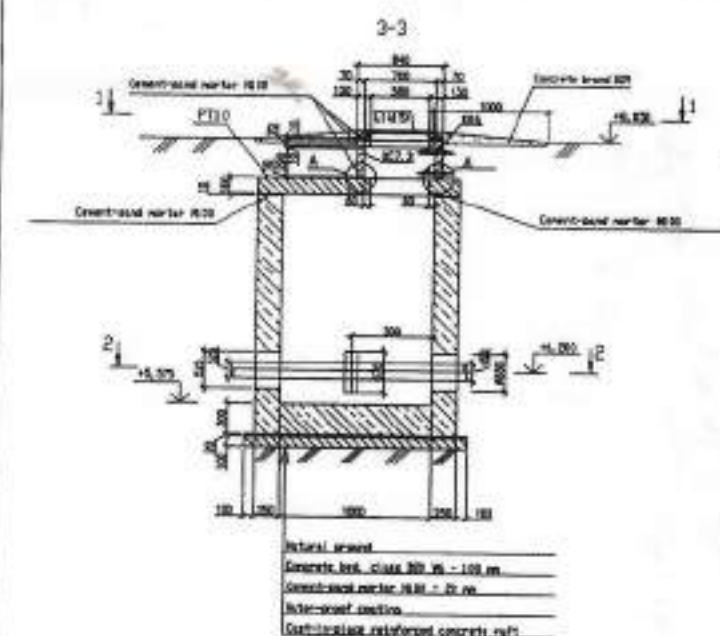
R.C.C. detail of wallBalakrishna  
25.9.07

FE(1)


R.C.C. details of base slab.  
300 HSK



Pos.	Detail position	Name	Unit
MATERIALS			
0007 0004-05	Rebar	11/14/20	1
0007 0009-05	Support ring	126	1
00-00-01 001-02 00 0000	Reinforced ring of steel	126	1
1 11 100-100	Reinforcing mesh	11/14/20	1
see note No. 1	Covering mesh	PT	1
Materials			
00 00 00 00 00 00	Concrete sealant	11/14/20	1
00 00 00 00 00 00	Concrete sealant	11/14/20	1
00 00 00 00 00 00	Concrete sealant	11/14/20	1



1 Surface waterproofing 1.5 in thick shall be performed on the external side of the well over the foundation slab, on the side surfaces of walls up to top of wall and over the floor top in compliance with BS 8102:1990 "Technical requirements for waterproofing of underground parts of buildings and structures".

2 Inside the well, the surface waterproofing 1.5 in thick shall be performed over the bottom surface and side surfaces of walls in compliance with BS 8102:1990 "Technical requirements for waterproofing of underground parts of buildings and structures".

3 Partition 2 shall be installed with 12 mm protecting layer.

4 Covering plate details shall be done as PT10/05 No. 00-00-01-02-00-0000 except that the overall dimensions shall be as given in this drawing.

PCB 51 & 52 LINES FLANGE JOINT ACCESS WELLS  
NEAR 05 UKD

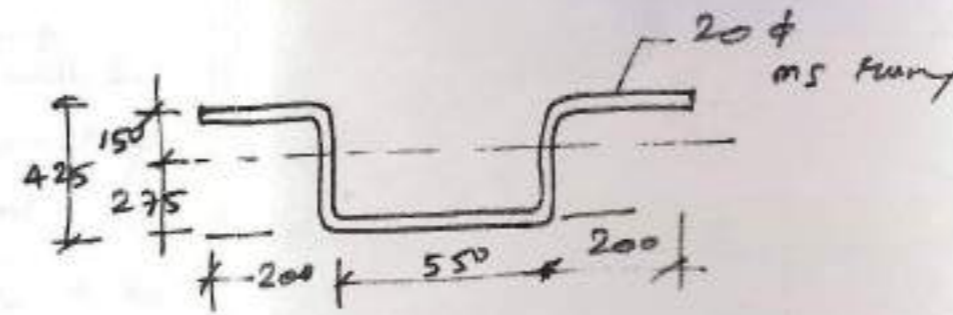
10/10/20  
H. Rajamoni  
50/PCRS

PCB 51 / PCB 52

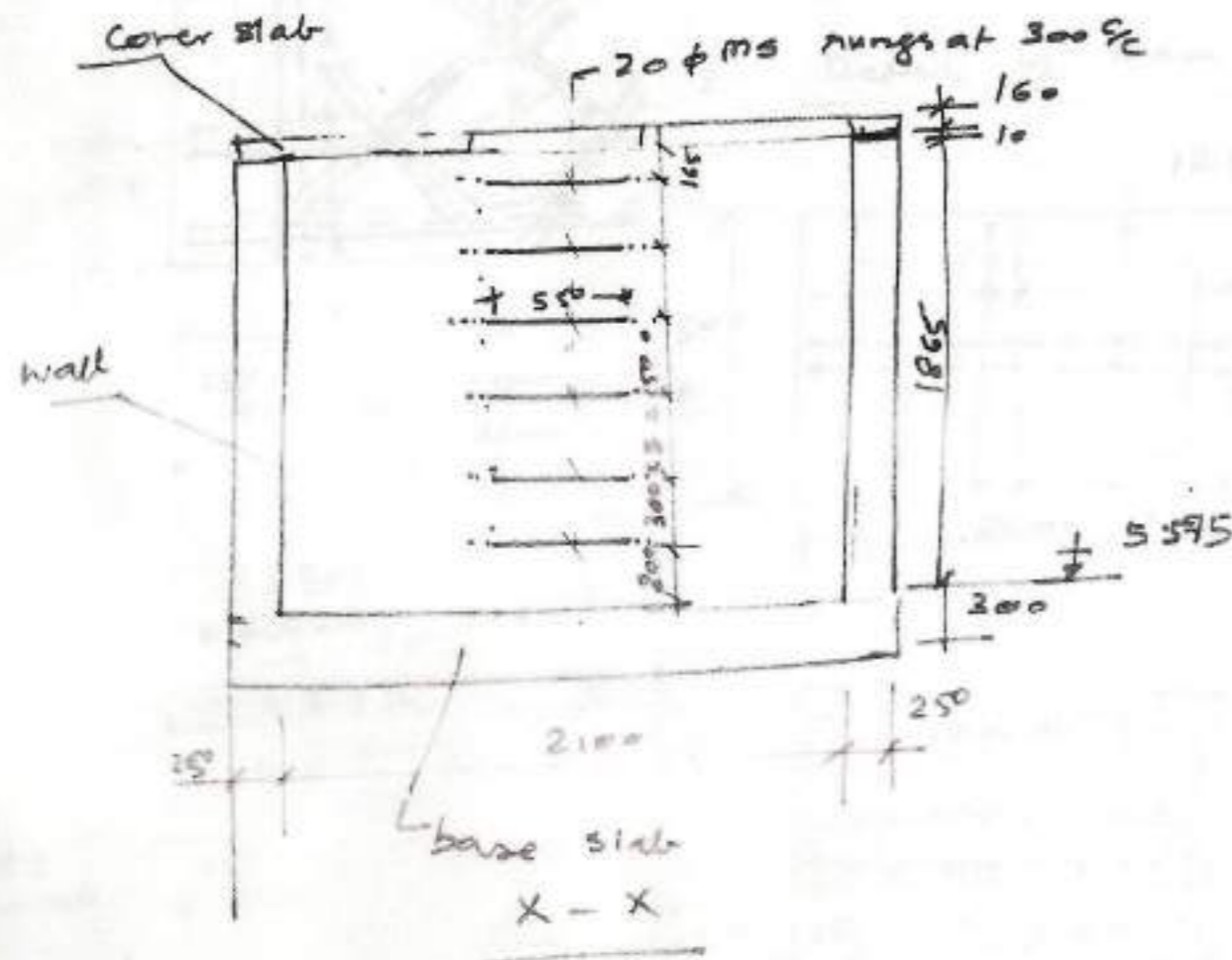
Notes:

2. Material of structural steel:  $f_y 250 \text{ N/mm}^2$   
IS 2062 - gr. A.

4. Pipe sleeves / EPs shall be provided as per the process requirement.



6 no: required  
truss for  
each well



10.10.07  
FE(c)

## Reinforcement detail of Access wells

Near O 5 UKD

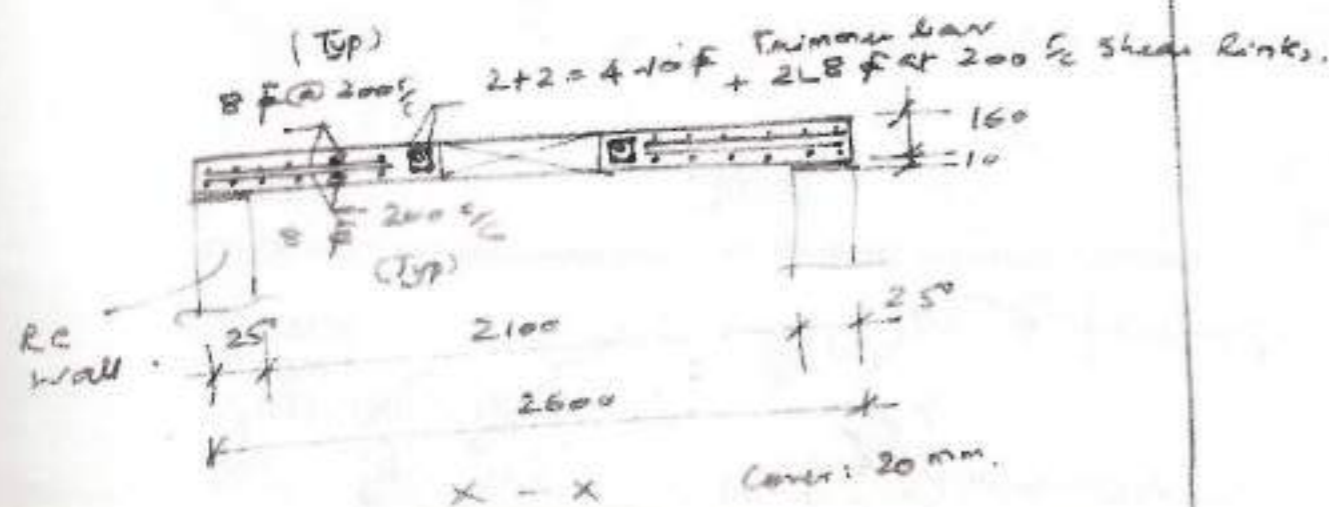
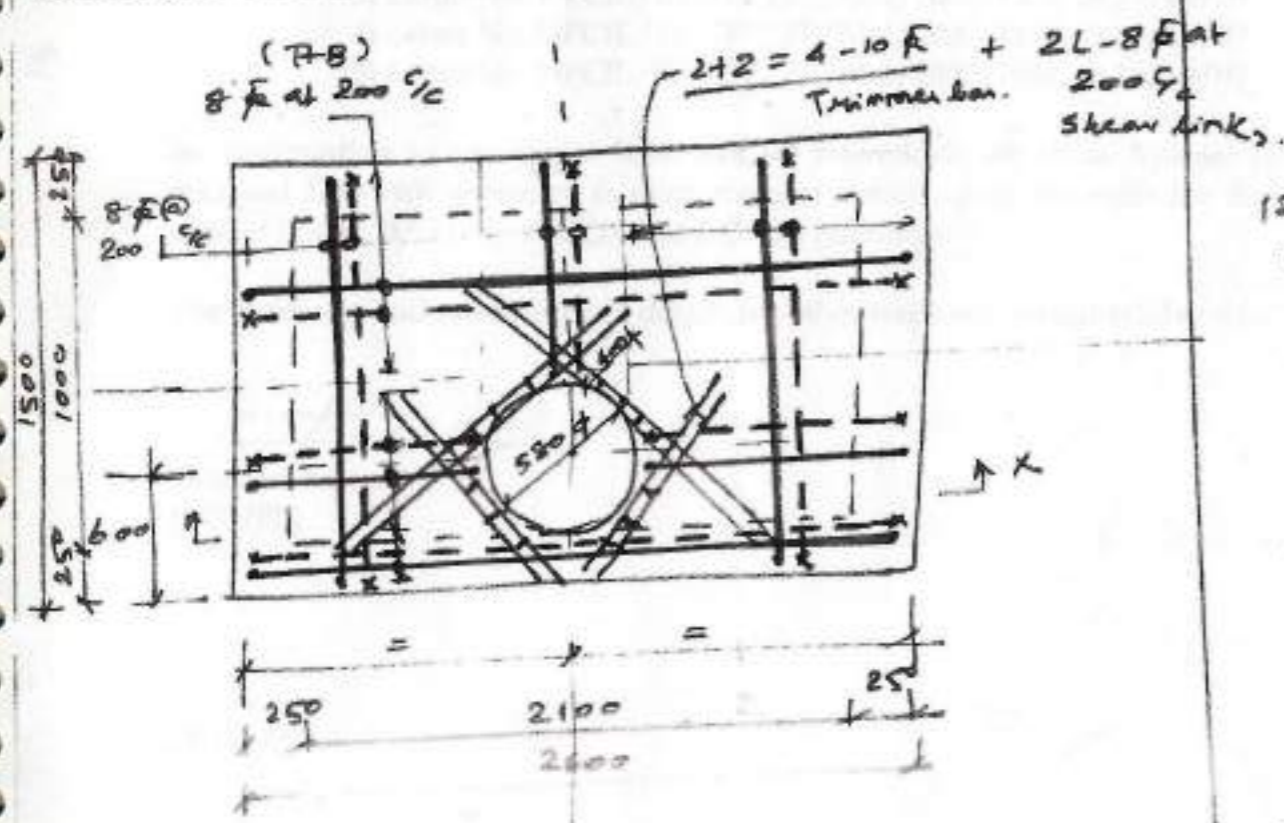
Coordinates	PCB 51	PCB 52
Easting	552.0 E	552.0 E
Northing	128.1 N	127.4 N
	143.1 N	142.4 N

2 Nos  
9  
wells

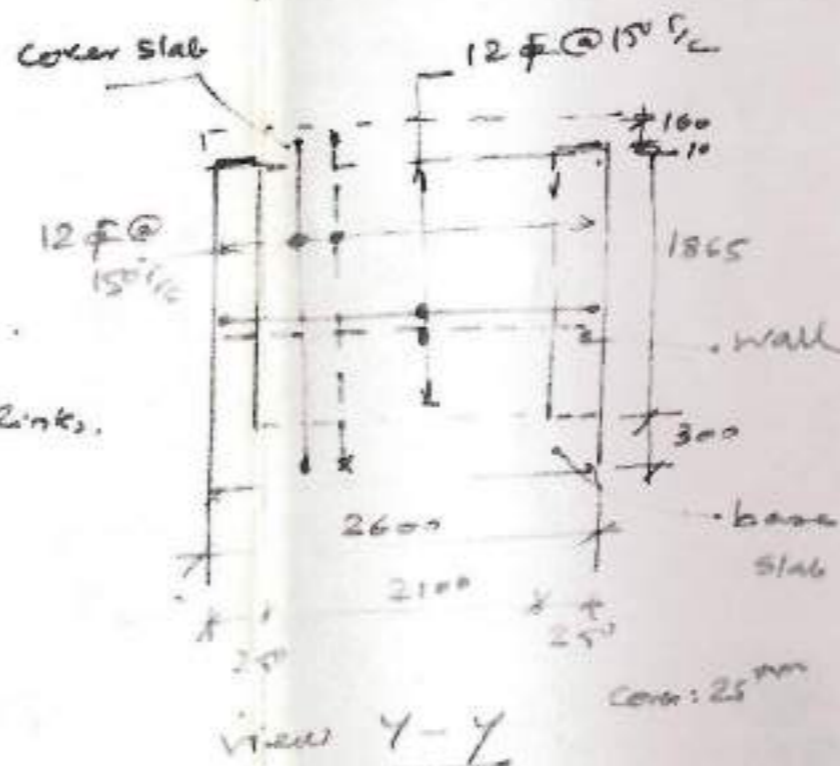
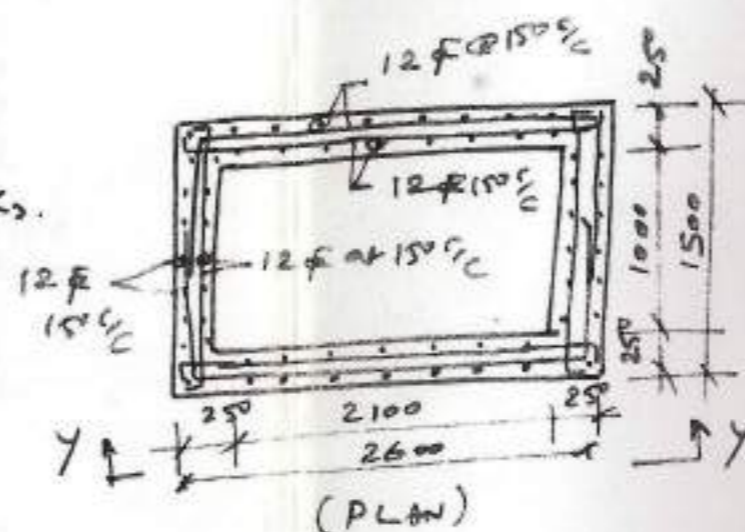
## Notes:

1. All dimensions are in mm u.n.o
2. grade of concrete: M30 as per BIS 456-2000
3. grade of Reinf steel: Fy 415 BIS-1786
4. All EPs (Pipe sleeves) shall be provided as per geometry and process requirement.
5. Bar Bending Schedule to be developed at site.

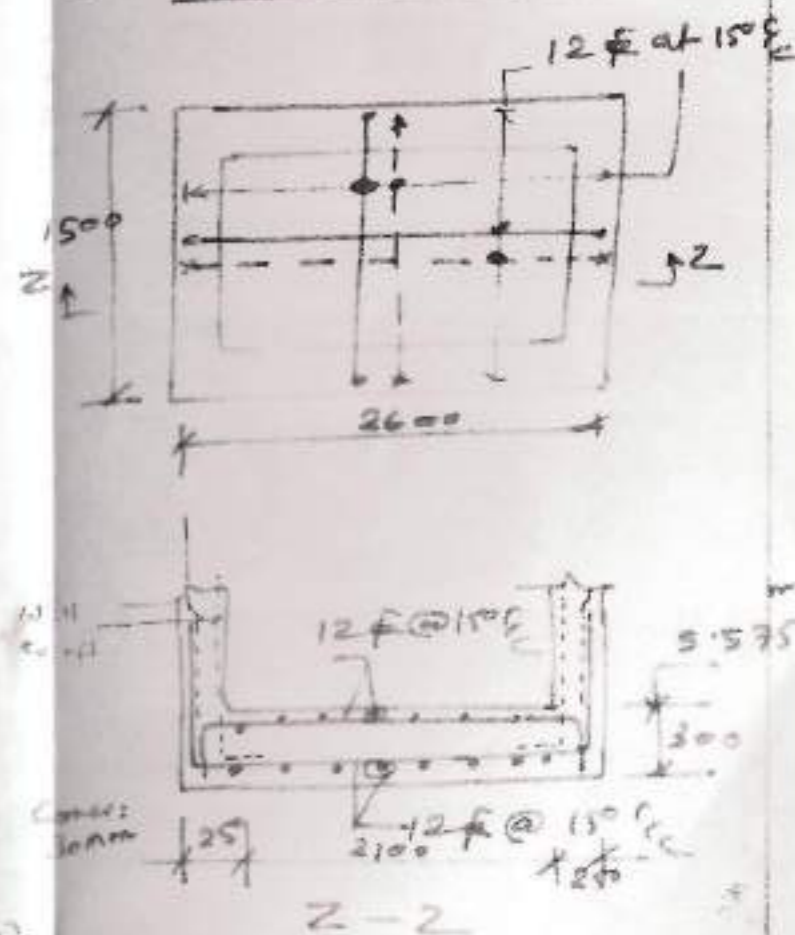
## 1. R.C. details of cover slab



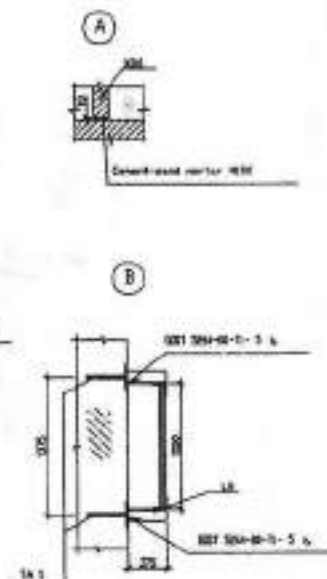
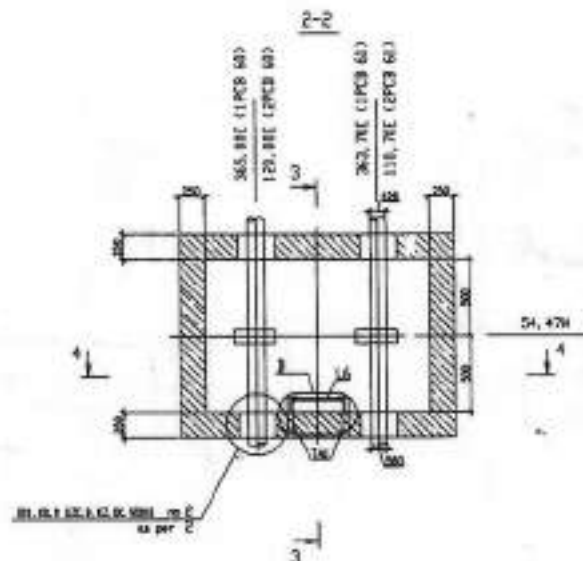
## 2. R.C. Wall



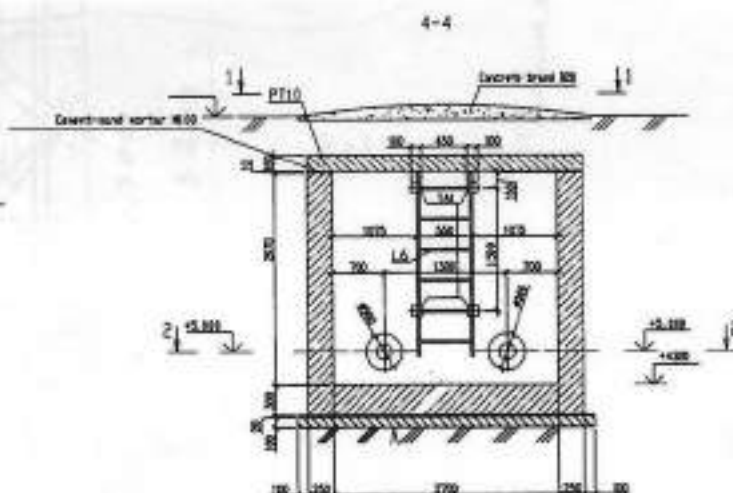
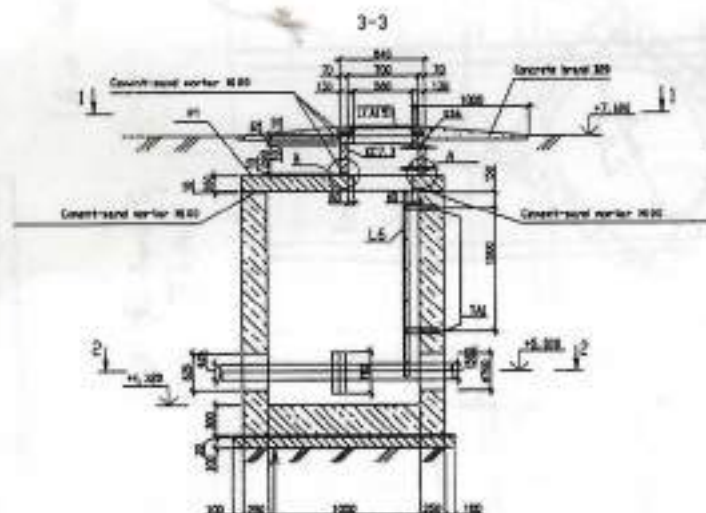
## 3. Detail of Base Slab



by Balaji Sharma  
10.10.20



Pos.	Description	Name	QTY per unit	Notes
		<u>Assembly 2017</u>		
	QDIT 3636-00	Bracket	1.0000	1
	QDIT 8628-00	Support ring	001	
	991 00 0 002 0 02 00 0001	Assembly ring of neck Ø 7.7		2
1	10 1044-000	sliding flange Ø 3.15, 3900 mm		4, 4
	Low neck No. 4	sliding plate	PE	1
	991 00 0 002 0 02 00 0001	Collected part	140	4
	991 00 0 002 0 02 00 0001	Drill holder	140	1
		<u>Subtotal</u>		
		QD 36 type concrete	m <sup>3</sup>	0.7
		Concrete ready mix C20	m <sup>3</sup>	0.7
	00 0 0 02 71 00002	Concrete ready mix "Black" type	m <sup>3</sup>	0.4



PCB 60 & 61 UNES FLANGE JOINT ACCESS WELL  
NEAR 1 UDA AND 2 UDA

1. Surface waterproofing 1.5 in. thick shall be performed on the external side of the wall over the foundation wall, on the side surfaces of walls up to basement level and over the floor top in compliance with KS, S. 9, KS, T. 10002.  
\*Technical requirements for waterproofing of underground parts of buildings and structures.

The measures of surface waterproof protection against mechanical damage during backfilling shall be envisaged in form execution design according to the Customer's practice.

2. Inside the well, the surface waterproofing 1.5 mm thick shall be performed over the bottom surface and side surfaces of wells. In compliance with EN 12068, EN 12069 (Technical requirements for waterproofing of underground parts of buildings and structures).

3 Position 1 shall be installed with 10 mm protective layer.

† Covering plate details shall be same as PT-10 (S&W No. 81-XL-5) SEE FIG. 2, ROOM 201-10 except that the overall dimensions shall be as given in this drawing.

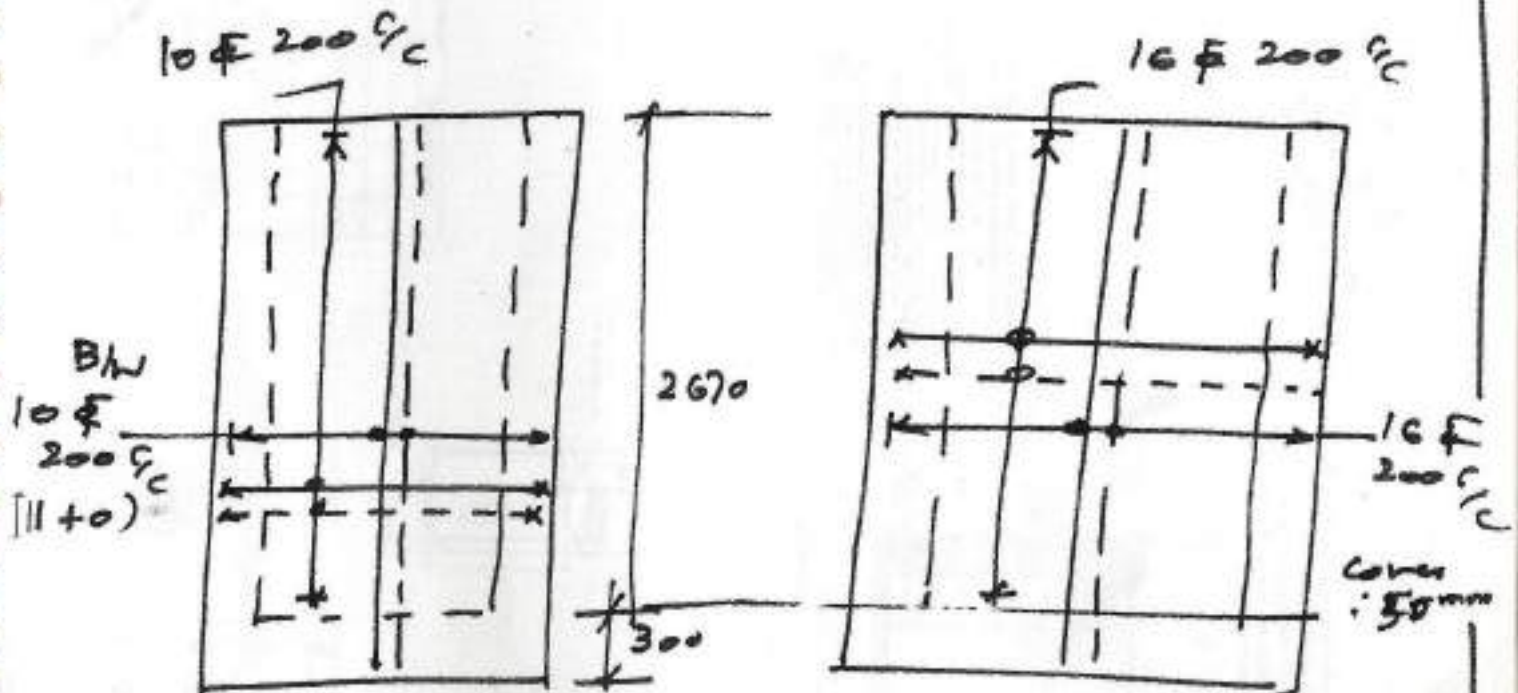
Wade  
H. L. Mark  
SOP (FE)



R.C.C. details of  
Base slab &  
walls

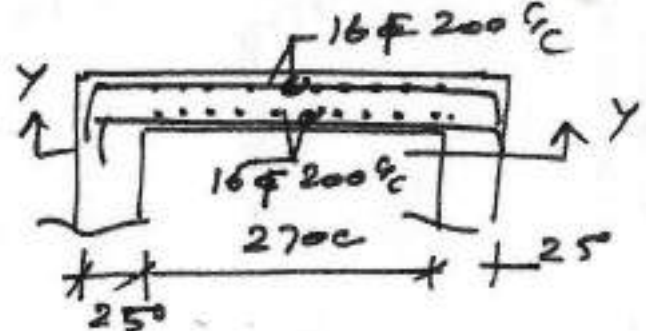
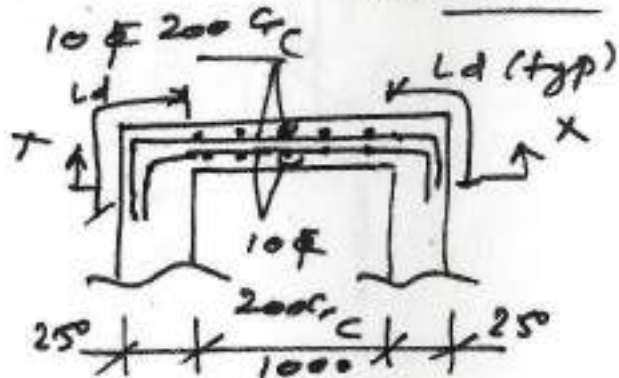
PCB 60  
PCB 61 sh. 3/3

Annexure 'd'



view X-X

view Y-Y



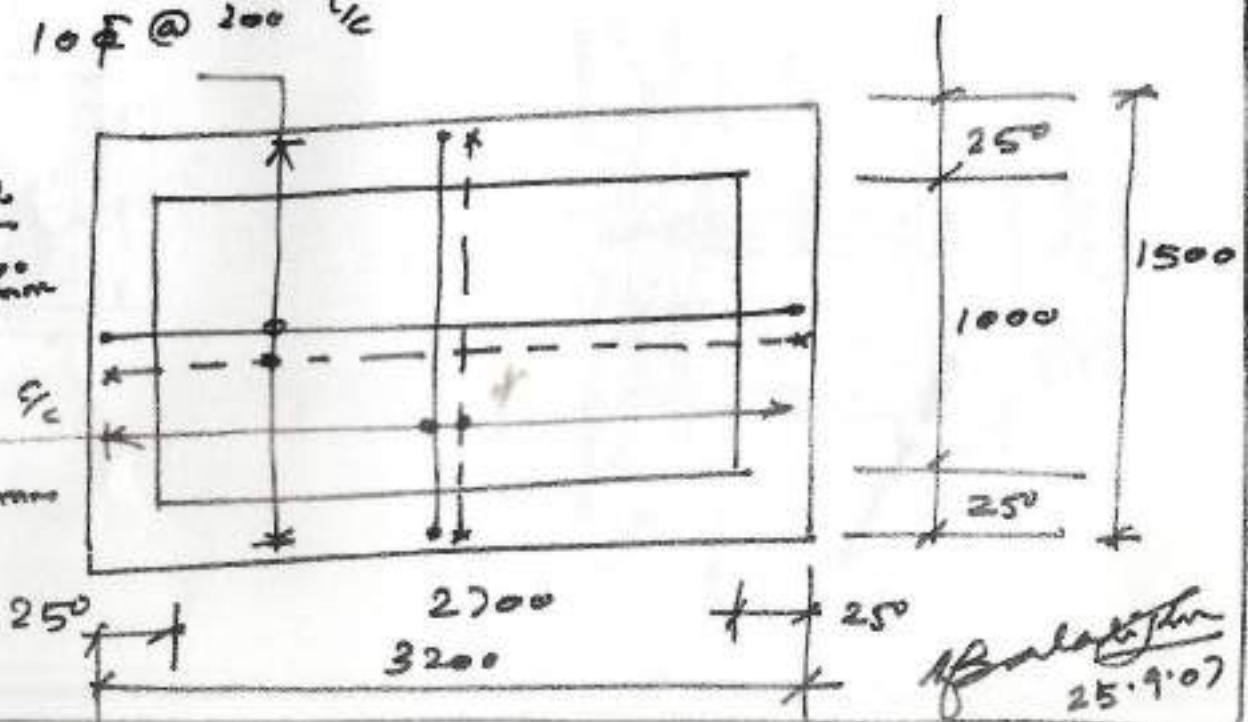
10  $\Phi$  @ 200  $\Phi$ c

Base slab

1000 mm

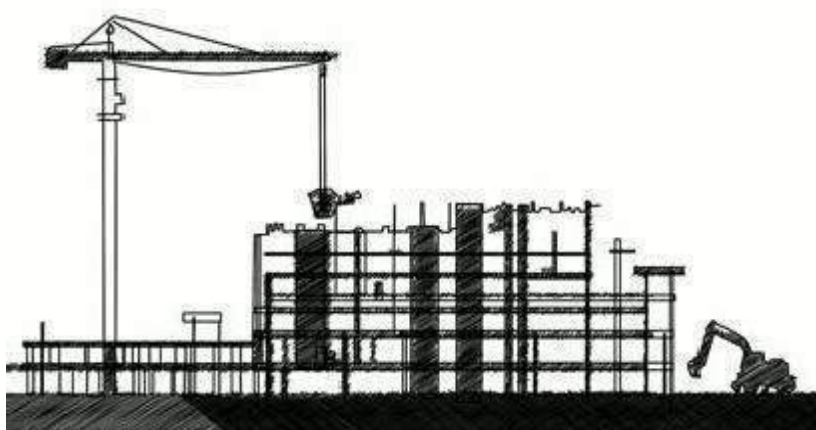
10  $\Phi$  200  $\Phi$ c

Cover : 50 mm



Balaji  
25.9.07

CE 10



# **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	
	<b>Manpower</b> <ul style="list-style-type: none"><li>1 (one) safety officer for every 500 workers or part thereof</li><li>1(one) safety-steward/ supervisor for every 100 workers</li></ul> <b>Qualification</b> As per Cl. 7.1	<b>HSE Roles and responsibilities</b> <ul style="list-style-type: none"><li>Site In-charge- As per clause 7.2.1</li><li>Safety officer- As per clause 7.2.2</li></ul>
	HSE Planning for Man, Machinery/Equipment/Tools & Tackles	
PROVIDE	HSE INFRASTRUCTURE	
	<ul style="list-style-type: none"><li>PPEs</li><li>Drinking Water</li><li>Washing Facilities</li><li>Latrines and Urinals</li><li>Provision of shelter for rest</li><li>Medical facilities</li></ul>	<ul style="list-style-type: none"><li>Canteen facilities</li><li>Labour Colony</li><li>Emergency Vehicle</li><li>Pest Control</li><li>Scrapyard</li><li>Illumination</li></ul>
TRAIN	HSE TRAINING , AWARENESS & PROMOTION	
	<b>Training</b> <ul style="list-style-type: none"><li>Induction training</li><li>Height work and other critical areas</li><li>Tool Box talk &amp; Pep Talk</li></ul>	<b>Awareness &amp; Promotion</b> <ul style="list-style-type: none"><li>Signage</li><li>Poster</li><li>Banner</li><li>Competition</li><li>Awards</li></ul>
COMMUNICATE	HSE COMMUNICATION	
	<b>Incident Reporting</b> <ul style="list-style-type: none"><li>Accident- Fatal &amp; Major</li><li>Property damage</li><li>Near Miss</li></ul>	<b>Event Reporting</b> <ul style="list-style-type: none"><li>Celebrations</li><li>Training</li><li>Medical camp</li></ul>

## 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

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Welding</li> <li>• Rigging</li> <li>• Cylinder- storage &amp; Movement</li> <li>• Demolition work</li> <li>• T&amp;Ps</li> <li>• Chemical Handling</li> <li>• Electrical works</li> </ul> | <ul style="list-style-type: none"> <li>• Fire</li> <li>• Scaffolding</li> <li>• Height work</li> <li>• Working Platform</li> <li>• Excavation</li> <li>• Ladder</li> <li>• Lifting</li> <li>• Hoisting appliance</li> </ul> |
|--|---|

#### HOUSE KEEPING

#### WASTE MANGEMENT

#### TRAFFIC MANAGEMENT

#### ENVIRONMENTAL CONTROL

#### EMERGENCY PREPAREDNESS AND RESPONSE PLAN

## CHECKS

#### HSE AUDITS & INSPECTION

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Daily Checks</li> <li>• Inspection of PPEs</li> <li>• Inspection of T&amp; Ps</li> <li>• Inspection of Cranes &amp; Winches</li> </ul> | <ul style="list-style-type: none"> <li>• Inspection of Height work</li> <li>• Inspection of Welding and Gas cutting</li> <li>• Inspection of elevators etc.</li> </ul> |
|---|--|

#### 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.

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	<b>POWER SECTOR</b>		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:  <b>HSEP:14-F30 – Monthly HSE Planning &amp; Review</b> (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)  <b>HSEP:14-F31A – Daily HSE Reporting</b> (Page 18, Clause 10.3 – added)  <b>HSEP:14-F33 – HSE Performance Evaluation</b> (Page 31, Clause 13 – revised)	IOM No.  <b>PSHQHSE/M ONREP/02</b>  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/ Supervisor	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 work site.
- 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:
  - Mobile cranes.
  - Side Booms.
  - Forklifts.
  - Grinding machine.
  - Drilling machine.
  - Air compressors.
  - Welding machine.
  - Generator sets.
  - Dump Trucks.
  - Excavators.
  - Dozers
  - Grit Blasting Equipment.
  - 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 selections 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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S. No.	Location	Illumination (Lux)
<b>A. Construction Area</b>		
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 rough measurements etc.	300
7.	Fine work like precision assembly, precision measurements etc.	700
8.	Sheet metal works	200
9.	Electrical and instrument labs	450
<b>B. Office</b>		
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:
  - Details of the job being intended for immediate execution.
  - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
  - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
  - Recent non-compliances observed.
  - Appreciation of good work done by any person.
  - 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:
  - Hazards identification and risk analysis (HIRA)
  - Work Permit System
  - Incident investigation and reporting
  - Fire fighting
  - First aid
  - Fire-warden training
  - EMS and OHSMS
  - T & Ps fitness and operation



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- Electrical safety
- Welding, NDE & Radiological safety
- 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:

- A high level of stability.
- A safe means of access/egress.
- Suitable and effective service and parking brakes.
- Windscreens with wipers and external mirrors giving optimum all round visibility.
- Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- Provision of seat belts.
- Guards on dangerous parts.
- Driver protection - to prevent injury from overturning and from falling objects/materials.
- Driver protection from adverse weather.
- No vehicle shall be parked below HT/LT power lines.
- 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.
  - Brakes.
  - Tires.
  - Steering.
  - Mirrors.
  - Windscreen waters.
  - Wipers.
  - Warning signals.
  - 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
  - Fall arrestor
  - Lifelines
  - Safety nets
  - Fencing and barricading
  - Warning signage
  - Covering of opening
  - Proper scaffolding with access and egress.
  - 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:
  - Implementation of earlier MOM
  - HSE performance
  - HSE inspection
  - HSE audit and CAPA
  - HSE training
  - Health check-up camp
  - HSE planning for the erection and commissioning and installation activities in the coming month
  - 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
<b>HOUSEKEEPING</b>				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
<b>PERSONNEL PROTECTIVE EQUIPMENTS</b>				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
<b>EXCAVATIONS / OPENINGS</b>				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
<b>WELDING, CUTTING</b>				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
<b>SCAFFOLDING</b>				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
<b>LADDER</b>				
Extension side rails 1 m above				
Top of landing				
Properly secured				



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Angle + 70° from horizontal				
Other				
<b>HOISTS, CRANES AND DERRICKS</b>				
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				
<b>MACHINERY, TOOLS &amp; EQUIPMENT</b>				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
<b>VEHICLE AND TRAFFIC</b>				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
<b>TEMPORARY FACILITIES</b>				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
<b>FIRE PREVENTION</b>				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
<b>ELECTRICAL</b>				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
<b>HANDLING &amp; STORAGE OF MATERIALS</b>				
Properly stored or stacked				
Passageways clear				
Other				
<b>FLAMMABLE GASES AND LIQUIDS</b>				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				



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Other				
<b>WORKING AT HEIGHT</b>				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
<b>ENVIRONMENT</b>				
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.				
<b>HEALTH CHECKS</b>				
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

PAGE NO. 01 OF 02

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

REV NO.: 00

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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

PAGE NO. 1 OF 02

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
<b><u>General Physical Examination</u></b>	
Height	:
Weight	:
BMI	:
Built And nourishment	:
Pallor	:
Temperature	:
Chest Expansion	: Inspiration Expansion
Lymph Node Enlargement	:
<b><u>Ear, Nose, Throat</u></b>	:
Ear	:
Nose	:
Throat	:

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:14-F02

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EXAMINATION	OBSERVATION
<b><u>Cardiovascular System Examination :</u></b>	
Inspection :	
Palpation :	Pulse BP
Auscultation (Heart Sounds) :	
<b><u>Respiratory System :</u></b>	
Inspection :	Respiratory Rate
Palpation:	
Percussion :	
Auscultation (Breath Sounds) :	
<b><u>Examination of Abdomen :</u></b>	
Inspection :	
Palpation :	
Auscultation (Bowel Sounds) :	
<b>Any Other :</b>	
<b>Clinical Impression</b>	

Signature of the examining doctor

**POWER SECTOR****HSE INDUCTION TRAINING**

FORMAT NO: HSEP:14-F03


REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Sl No.	Name	Designation	Organisation	Signature


Signature of Training co-ordinator :

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F04 REV NO.: 00 PAGE NO. 01 OF 01
	<b>TOOL-BOX TALK</b>	

<b>Name of Site :</b>	
<b>Sub-Contractors Name :</b>	
<b>Date :</b>	

Topic	Name of person delivered Tool Box Talk	No. of Participants attended	Remarks


**Signature of Site I/C of Subcontractor :**

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F06 REV NO.: 00 PAGE NO. 01 OF 01
	<b>PERSONAL PROTECTIVE EQUIPMENTS</b>	

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection :</b>	

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 :

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F07 REV NO.: 00 PAGE NO. 01 OF 01
	<b>INSPECTION OF T&amp;Ps</b>	

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Date of Inspection :</b>	

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)	

<b>Signature-Site Safety Officer ( BHEL)</b>	<b>Signature-Subcontractor/ Subcontractor's Safety Officer</b>
--	--

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F08 REV NO.: 00 PAGE NO. 01 OF 01
	<b>STATUS OF T&amp;Ps</b>	

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Date of Inspection</b>	

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

REV NO.: 00

PAGE NO. 01 OF 03

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

REV NO.: 00

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?				
	<b>Total Number of NO:</b>				
	<b>Total Number of NA:</b>				
	<b>% Compliance :</b>				

Signature of Site I/C of subcontractor :

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F10 REV NO.: 00 PAGE NO. 01 OF 02
	<b>INSPECTION OF HEIGHT WORKING</b>	

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection:</b>	

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.		
	<b>ACCESS/EGRESS</b>		
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.		
	<b>Housekeeping</b>		
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.		
	<b>PPE And Safety Devices</b>		
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 :

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F12 REV NO.: 00 PAGE NO. 01 OF 02
	<b>INSPECTION OF ELECTRICAL INSTALLATION</b>	

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Inspected by</b>	
<b>Date of Inspection:</b>	

Sr. No.	Contents	Yes/No	Remarks
<b>A</b>	<b>Cable</b>		
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>B</b>	<b>DBs/SDBs</b>		
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?		
<b>C</b>	<b>ELCB</b>		
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?		
<b>D</b>	<b>Grounding</b>		
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.		
<b>E</b>	<b>Electrically operated Machines or Accessories.</b>		
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 :

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F13 REV NO.: 00 PAGE NO. 01 OF 01
	<b>INSPECTION OF ELEVATOR</b>	

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Inspected by</b>	
<b>Date of Inspection</b>	

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)	
<b>Signature-Subcontractor/ Subcontractor's Safety Officer</b>		<b>Signature-Site Safety Officer ( BHEL)</b>

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F13E REV NO.: 00 PAGE NO. 01 OF 01
	<b>Inspection of Excavation</b>	

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection :</b>	

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.



	<b>POWER SECTOR- HQ</b>	FORMAT NO: HSEP:14-F15 REV NO.: 00 PAGE NO. 01 OF 01
	<b>Incident Report</b> (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. ...	

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F3o REV NO.: 00 PAGE NO. 02 OF 3
	<b>Format for Monthly HSE Planning &amp; Review</b>	

SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
14	Job Safety Analysis as per Format F32B	<b>Activities:</b> <b>1. ...</b>	
15	Regular Job Specific Training (Re-training) for workers involved in hazardous activities	Topics/ Hazards & No. of workers <b>1. ...</b>	
16	Mass housekeeping (HK) drive in work areas	Areas <b>1. ...</b>	
17	Vertigo Test of Height workers	Minimum No. of workers:	
18	Deployment of qualified HSE Officers as per contract	Location(s) & Nos. <b>1. ...</b>	
19	Deployment of qualified HSE Stewards as per contract	Location(s) & Nos. <b>1. ...</b>	
20	Deployment of Safety tools & Equipment (Safety Nets, Lifelines, Fall arrestors, Man-cages, flashback arrestors, scaffolding etc.)	Tool/ Equipment & Location <b>1. ...</b>	
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. <b>1. ...</b>	
24	Provision of clean drinking water sources for workers	Locations: Nos. <b>1. ...</b>	
25	Provision of toilets for workers (separate for male & female workers)	Locations: Nos. <b>1. ...</b>	
26	Rest sheds for workers during lunchtime, rain, dust storm etc.	Locations: Nos. <b>1. ...</b>	
27	Availability of following in Labor colony	<b>1. Clean drinking water</b> <b>2. Toilets</b> <b>3. Cleanliness &amp; Hygiene</b> <b>4. Grass cutting,</b> <b>5. Fogging</b> <b>6. Electrical Inspection ...</b>	


	<b>POWER SECTOR</b>		FORMAT NO: HSEP:14-F30 REV NO.: 00 PAGE NO. 03 OF 3
	<b>Format for Monthly HSE Planning &amp; Review</b>		
SN.	Description of HSE Activity & Formats	Plan & Targets for the month	Review
28	Availability of dust/ waste bins at various locations	Locations: <b>1.</b> ...	
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. <b>1.</b> ...	
32	Tree plantation	Locations & Nos. <b>1.</b> ...	
33	Waste disposal & Scrap Bins	Locations <b>1.</b> ...	
34	Illumination checks	Locations <b>1.</b> ...	
35	Safety award function: 1. Display of good practices Award presentation	Minimum 1 per month	
36	<b>Submission of Daily Reports as per Format No.F31A</b>	<b>Daily Reports (Night &amp; Day Shifts)</b>	

<b>PLAN</b>		<b>REVIEW</b>	
<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	

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

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	<b>POWER SECTOR</b>	FORMAT NO: HSEP:14-F31 A REV NO.: 00 PAGE NO. 01 OF 1
	Format for Daily HSE Reporting	

Night		Day	SHIFT	Year	Site
			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 <sub>2</sub> 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

	<b>POWER SECTOR- HQ</b>	FORMAT NO: HSEP:14-F33
	<b>Checklist for Evaluation of HSE Performance</b>	REV NO.: 00 PAGE NO. 03 OF 3

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)	<b>M</b>	2	Attendance records
9c	Availability of Ambulance facility 24 hours (Own or sharing basis)	<b>M</b>	2	-do-
9d	Is First aid trained personnel's are available and their names are displayed at site?	<b>M</b>	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**





 PSSR	<b>MONTHLY PLAN &amp; REVIEW WITH CONTRACTOR</b>	Page <b>2</b> of <b>6</b>
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	<b>MONTHLY PLAN &amp; REVIEW WITH CONTRACTOR</b>	Page <b>4</b> of <b>6</b>
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

## Date of Plan .....

[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.

**CONTRACTOR**  
(Sign with name, designation and date)

 PSSR	<b>MONTHLY PLAN &amp; REVIEW WITH CONTRACTOR</b>	Page <b>6</b> of <b>6</b>
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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)

Project		Vendor			Package/Unit	
Sl. No.	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. No.	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	Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month as per Form-14	PERFORMANCE	35		As per Part-A of Form-14	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. No.	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	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B2 of Form-14	Daily Log Book entry/Incident Registers/letter references
#3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B1 of Form-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. No.	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
#6.0	Performance against HSE Parameters (as per Annexure-AA)	HSE	10		Score as per Safety Performance Evaluation System, scaled down to 10	Safety Performance Evaluation System
Total			100			

Less Deduction in Score Due to Fatal Accidents attributable to the Contractor @ 20 points/ accident	
Less Deduction in Score Due to Major Accidents (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.) attributable to the contractor @ 15 points/ accident	
Less Deduction in Score Due to Minor Accidents attributable to the contractor @ 2 points/ accident	
Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @3 points in a month on verification any day	
Final Score	

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
	Performance Score Summary for the Month	Total Score	Score Obtained			
	QUALITY	10				
	PERFORMANCE	50				
	RESOURCES	20				
	SITE INFRASTRUCTURE & SERVICE	5				
	SITE FINANCE	5				
	HSE	10				
	OTHERS (deductions if any)	0	-			
	TOTAL	100				

Note:

- 1) It is only indicative and shall be as per the online format issued by BHEL time to time.
- 2) No request will be entertained after specified date of current month w.r.t. changes requested in the scores of immediate previous month.

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

Monthly Safety Performance Evaluation of Contractor

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, colour 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
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 <sub>2</sub> 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

7a	Whether Scaffolding pipes made with steel or aluminium, 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 centre, 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:

- Ø M: Mandatory; O: Optional. Points other than mandatory can be excluded with appropriate justification (scope etc.) by BHEL. Score obtained in selected parameters divided by maximum possible score of selected parameters shall be multiplied by 10 for use in as per point Sl. no. # 6.0 as detailed at page 4 of Form F-15.
- Ø There shall be deduction of marks from overall score for Fatal/ Major/ Minor Accidents and for not maintaining labour colony, as detailed at page 4 of Form F-15.

**REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR  
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
I.	CRANES :-			
1	Portal Gantry Crane 500T	15	20100.00	19980.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	11370.00	11320.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	56290.00	55940.00
4	PORTAL CRANE, 360T	15	14070.00	13980.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	55110.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	68610.00	68180.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	33510.00	33300.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	20940.00	20810.00
9	MANITOWOC M-250T TRUCK CRANE	15	30160.00	29970.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	31660.00	31470.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	26220.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	36110.00	36110.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	15130.00	15030.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	18850.00	18850.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	16750.00	16650.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	21780.00	21640.00
15	CRAWLER CRANE SUMITOMO, 150T	15	10890.00	10820.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	13400.00	13320.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	10830.00	10780.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	10720.00	10650.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	8880.00	8820.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	10050.00	9990.00
20	CRAWLER CRANE 100 T (KH 500)	15	10050.00	9990.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	5410.00	5390.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6140.00	6110.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5370.00	5340.00
24	Mobile Crane, 55MT (TIL)	12	4410.00	4390.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3030.00	3010.00
26	MOBILE CRANE, 20MT (TIL)	10	2270.00	2260.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2270.00	2260.00
28	MOBILE CRANE ESCORTS- 14MT	10	710.00	710.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	390.00	380.00
30	ELECTRIC GANTRY CRANE 3T	5	430.00	430.00
31	ELECTRIC GANTRY CRANE 5T	5	540.00	540.00
32	ELECTRIC GANTRY CRANE 30T	5	3640.00	3620.00
33	FORK LIFT 5T	5	650.00	650.00
34	FORK LIFT 3T	5	540.00	540.00

**REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR  
OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
I.	CRANES :-			
1	Portal Gantry Crane 500T	15	22340.00	22200.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	12630.00	12570.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	62160.00
4	PORTAL CRANE, 360T	15	15630.00	15540.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	61240.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	76230.00	75760.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	37000.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	23270.00	23120.00
9	MANITOWOC M-250T TRUCK CRANE	15	33510.00	33300.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	35180.00	34960.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	29320.00	29130.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	40120.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	16700.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	20950.00	20950.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	18610.00	18500.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	24200.00	24050.00
15	CRAWLER CRANE SUMITOMO, 150T	15	12100.00	12020.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	14890.00	14800.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11970.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	11910.00	11840.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	9860.00	9800.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	11170.00	11100.00
20	CRAWLER CRANE 100 T (KH 500)	15	11170.00	11100.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5980.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6790.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5970.00	5940.00
24	Mobile Crane, 55MT (TIL)	12	4900.00	4880.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3370.00	3350.00
26	MOBILE CRANE, 20MT (TIL)	10	2520.00	2510.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2510.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	790.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	430.00
30	ELECTRIC GANTRY CRANE 3T	5	480.00	480.00
31	ELECTRIC GANTRY CRANE 5T	5	600.00	600.00
32	ELECTRIC GANTRY CRANE 30T	5	4040.00	4030.00
33	FORK LIFT 5T	5	720.00	720.00
34	FORK LIFT 3T	5	600.00	600.00

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR  
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
<b>I.</b>	<b>LIFTING EQUIPMENTS</b>	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
<b>II</b>	<b>WELDING &amp; HEAT TREATMENT EQUIPMENT</b>	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
<b>III</b>	<b>SERVICE PLANTS &amp; ALLIED EQUIPT.</b>	0
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTRATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTRATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTRATION M/C, 250GPH/1000LPH (OTHER THAN SILICON	1360
6	OIL FILTRATION M/C, 500GPH/2500LPH (OTHER THAN SILICON	1820
7	OIL FILTRATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4240

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR  
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m <sup>3</sup> /Hr)	1160
22	Air Blower (Flow: 20000 m <sup>3</sup> /Hr)	940
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR  
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGNOSTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 $\mu\Omega$ TO 20K $\Omega$	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. : FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. : FLOW 15 M3/HR	430
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit ( Relay Test )	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR  
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
88	Flue Gas Analyser	1030
89	Oil Test Kit ( Mineral Oil)-Transformer	1010
90	Winding Resistance kit ( R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360

**RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS  
ETC. FOR OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	23250
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	350
3	MULTI SHEAVE PULLEY BLOCK 100T	700
4	MULTI SHEAVE PULLEY BLOCK 150T	1400
5	ELECTRIC WINCH 5T	1410
6	ELECTRIC WINCH 10T	2620
7	ELECTRIC WINCH 15 T	2390
8	PASSENGER CUM GOODS HOIST 1T	2520
9	FURNACE MAINTENANCE PLATFORM	5600
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2330
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	18190
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	9090
3	WELDING GENERATOR 320/300 A	330
4	WELDING RECTIFIER 400A/300A	330
5	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER,600A	330
8	TRANSFORMER 300/400A	220
III	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH	7070
3	-DO- , WITH STORAGE TANK	8080
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON	1510
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON	2020
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4710

# **RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 m <sup>3</sup> /Hr)	1290
22	Air Blower (Flow: 20000 m <sup>3</sup> /Hr)	1040
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	700
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1810
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	2000
4	-do- Gun with nose Assembly only	600
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	41090
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	880
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1210
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1410
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1480
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2480
7	BOLT STRETCHING DEVICE	1010
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	4040
9	ULTRASONIC FLAW DETECTOR	3030
10	MPI TEST KIT	400
11	GAS LEAK DETECTOR	300
12	VIBRATION/SOUND LEVEL METER IRD-306	400
13	VIBRATION/SOUND LEVEL METER IRD-308	400
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1610
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2830
16	SHOCK PULSE METER	700
17	HV.DC TEST KIT UPTO 50 KV	600
18	HV.DC TEST KIT ABOVE 50 KV	1110
19	HV.AC TEST KIT UPTO 50KV	900
20	HV.AC TEST KIT ABOVE 50KV	3230
21	MOTORISED MEGGER 2.5KV	440
22	MOTORISED MEGGAR 5KV	500
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	500
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1210

# **RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
25	WAVEFORM ANALYSER	1010
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1810
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1210
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	1010
29	DIGITAL LOW RESISTANCE METER	700
30	DC POTENTIOMETER	200
31	PRECISION DEAD WEIGHT TESTER	1110
32	OPTICAL ALIGNMENT KIT	1510
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1330
34	VERNIER THEODOLITE,PRECISION	1330
35	VERNIER THEODOLITE,ORDINARY	220
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGNOSTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast -	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH	510

**RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS  
ETC. FOR OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit ( Relay Test )	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit ( Mineral Oil)-Transformer	1120
90	Winding Resistance kit ( R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400

**BID SECURITY DECLARATION**  
**(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)**

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To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **BID SECURITY DECLARATION**

Ref : 1) NIT/Tender Specification No .....,  
2) All other pertinent issues till date

We hereby accept that if we withdraw our offer /modify /change / alter / impair /derogate the offer on our own after Opening of Tender or within the subsistence of the validity period of offer or fail to accept the Letter of Intent/Award issued by BHEL or if we are awarded the contract and we fail to sign the contract, or to submit the Bid bond and/or Security Deposit before the deadline defined in the Tender Document or if we furnish forged/bogus certificates, we will be suspended from being eligible to submit Bids for Contracts with BHEL-PSSR/ BHEL, for a period as per extant BHEL guidelines.

We also agree that unilateral revision or withdrawal of offer by us as mentioned above shall also result in rejection of bid/our offer without Notice.

COMPANY SEAL

SIGNATURE

NAME

DESIGNATION

COMPANY NAME

DATE

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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, Tek Towers, No.11, Old Mahabalipuram Road, Okkiyam Thoraipakkam, Chennai - 600097* having agreed to exempt \_\_\_\_\_<sup>1</sup> (Name of the Vendor / Contractor / Supplier) with its registered office at \_\_\_\_\_<sup>2</sup> (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 \_\_\_\_\_<sup>3</sup> valued at Rs. \_\_\_\_\_<sup>4</sup> (Rupees \_\_\_\_\_ only)<sup>4</sup> (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. \_\_\_\_\_<sup>5</sup> (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. \_\_\_\_\_<sup>5</sup>.

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 \_\_\_\_\_<sup>6</sup> 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 \_\_\_\_\_<sup>7</sup>, 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.....<sup>5</sup>
- b) This Guarantee shall be valid up to .....<sup>6</sup>
- c) Unless the Bank is served a written claim or demand on or before \_\_\_\_\_<sup>7</sup> 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)

<sup>1</sup> NAME OF VENDOR /CONTRACTOR / SUPPLIER

<sup>2</sup> REGISTERED OFFICE ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

<sup>3</sup> LETTER OF INTENT(LOI) REFERENCE NO. WITH DATE

<sup>4</sup> CONTRACT VALUE (AS MENTIONED IN LOI)

<sup>5</sup> BG AMOUNT IN FIGURES AND WORDS

<sup>6</sup> VALIDITY DATE

<sup>7</sup> 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:

<b>Sl No</b>	<b>Particulars</b>	<b>Amount</b>
<b>1</b>	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.
<b>2</b>	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)

<b>Sl No</b>	<b>Particulars</b>	<b>Amount</b>
		<p>In cases involving claim and/or counter-claim of more than Rs 10 crores.</p> <p>Rs 1,00,000/- (per Conciliator)</p> <p>Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on the,</p> <p>Signing of the Settlement Agreement after approval of the Competent Authority</p> <p>or</p> <p>Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.</p>
<b>3</b>	Secretarial expenses	<p>Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC.</p> <p>Where Conciliation is by multi member Conciliators –Rs 30,000/- (one time)- to be paid to the IEC</p>
<b>4</b>	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	<p>As per the extant entitlement of whole time Functional Directors in BHEL.</p> <p>Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.</p>
<b>5</b>	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 /

<b>Sl No</b>	<b>Particulars</b>	<b>Amount</b>
		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):

<b>SI. No.</b>	<b>Description of claim(s)/Counter Claim</b>	<b>Amount (in INR)Or currency applicable in the contract</b>	<b>Relevant contract clause</b>

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.