BHARAT HEAVY E ECTRICA S IMITED
(भारत हेवी इलेक्ट्रिकल्स लिमिडे)
KUDANKULAM NUCLEAR POWER PROJECT UNIT-3&4

TENDER. NO.: BHEL/PSSR/KKNPP-3 & 4/TSS/SCT-063

TENDER SPECIFICATION (TS)/ TECHNICAL CONDITIONS OF CONTRACT (TCC)

For

"Handling, transportation, pre-fabrication, assembly, welding, erection, inspection of piping and erection of small-bore piping in Secondary Cycle Piping (QUC, QUG, QUH, LCM90, QUA, QUB, JEA50, LCS, LCT51 system) of Turbine Building (UMA) building, Unit#3 Including Receipt of materials, handling, transportation to contractor shop, un-crating and preservation of the balance"

at

Radhapuram Taluk, Tirunelveli District, Tamil Nadu-627106

Unit-3 &4 of 2x1000 MW Kudankulam Nuclear power project,

बीएच ईएल
BHEL
Maharatna Company

BHARAT HEAVY ELECTRICALS LIMITED

BHARAT HEAVY ELECTRICALS LIMITED
(भारत हेवी इलेक्ट्रिकल्स लिमि□ड)

(A Government of India Undertaking)
Power Sector – Southern Region
Kudankulam-3 & 4 Site)

CONTENTS

TENDER. NO.: BHEL/PSSR/KKNPP-3 & 4/TSS/SCT-063

SCOPE, TERMS & CONDITIONS

1. SCOPE

- Shifting, Handling, Fit up, welding, weld visuals, Erection of pipes and supports in LDB piping system in 3UMA.
- Schedule of Quantities as per Annexure 1
- T&Ps and consumables required for the work to be arranged by the agency
- Period of Contract will be 12 months
- Work shall be carried out as per the approved work procedures – I46/KK34/0/0/CC/WPR/WD018 – R01 (CS Piping), I46/KK34/0/0/CC/WPR/WD007 (SS Piping) and quality plan - I46/KK34/0/0/QA/QP/WD027 – R01 (CS Piping), I46/KK34/0/0/QA/QP/WD039 – R01 (SS Piping) only.
- The work shall be carried out as per the latest revision of drawings, DCNs, TARs only which will be issued from time to time.
- Agency shall assist for preparation of joint codification.
- Inspection of joint to be offered based on the approved (NPCIL approved) copy of joint codification.
- Joint identification, welder identification shall be punched/engraved near the joint while carrying out the fit up.
- There are some pipes, fittings already shifted to site, the same need to be identified and fit up, erection to be carried out. Already issued packages are available in BHEL yard. The material to be identified and to be shifted to site based on erection requirement.
- Arrangements shall be made by the agency for shifting of balance packages from M/s NPCIL. Package materials shall be returned to M/s NPCIL also. IMIR of the packages shall be carried out, assistance shall be provided for preparation of IMIR (Incoming Material Inspection Report).
- Valve testing facility will be provided by M/s BHEL. Agency shall engage manpower, hydra, trailer, T&Ps, minor consumables for shifting the valves to BHEL NIEP Intra area for carrying out the valve testing. After completion of testing the valves shall be shifted to site based on requirement of erection. Control valve, diaphragm valves, solenoid valves need not be tested.
- Mother Over, Portable Oven, holding over required for welding works to be arranged by the agency.
- The requirement of electrode shall be intimated in advance which will be issued as Free Issue Material from M/s NPCIL.
- Field register shall be maintained for various stages of Inspections in the formats prescribed by M/s BHEL/M/s NPCIL. WIR (Welding Inspection Report) shall be prepared and get signed as soon the work is completed.
- Inspection Offer shall be provided one day in advance to ensure timely availability of Execution & QA Personnel of M/s NPCIL. Format of RFI shall be as per the format.

- Welding shall be carried out only after written clearance of M/s NPCIL (Execution & QA) in field register/WIR
- Storage of electrodes, baking shall be as per the approved procedures and guidelines only.
- Welder qualification shall be carried out as per the approved procedure only. There are different ranges of qualification required. Welder shall be engaged only after obtaining the requisite qualification and welder ID card.
- SS materials shall not be in contact with CS materials.
- Temporary supports required for the work to be arranged by the agency. Material (like angle, channel, beam) required for temporary support will be provided by M/s BHEL.
- Daily work permit need to be taken before start of work.
- Penalty on account of the agency will be deductible from the bill.
- Labour licence, Statutory, safety requirements are in the scope of the agency.
- Statutory documents shall be compulsorily submitted for processing of the bills.
- IMTE (Testing & Measuring Instruments) required for Inspection shall be arranged.
- IMTEs shall have valid calibration certificates.
- T&Ps shall have valid Third Party Inspection Certificates by competent authority as applicable to KKNPP site
- Fire extinguishers as per the requirement shall be arranged
- Proper lighting to be ensured in the work area. Lux value as per NPCIL safety requirements to be met.
- CS structures/pipes shall be erected only after grit blasting & painting. Grit blasting & Painting is in the scope of M/s BHEL.
- Temporary structures required for the fit up, erection work shall be arranged by the agency.
- If the permanent supports cannot be erected during erection, work shall be continued with temporary supports.
- Cutting and edge preparation of the by using bevelling machine for the modification of field joints is in the above scope of work if necessary.
- The temporary structures / items welded to permanent members / pipes, temporary lugs / structures meant for transportation are to be cut and removed without any damage. In case of any damage, the same has to be made good by the contractor at his cost.
- Certain adjustments in length may be necessary while erection. Removing / adding extra lengths to suit the final layout, preparing edges afresh and adopting specified NDT procedure are in the Scope of work and well within quoted price.
- Only BHEL/NPCIL approved electrodes to be used for Temporary Support Structure and supply of such electrodes is the scope of Contractor.
- Russian Supplied Electrodes/Filler wire shall be provided by BHEL/NPCIL at Free of Cost for erection of permanent job only. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot.

- All expenses for testing of contractor's welders including destructive and Non-destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of Testing material required for making test pieces will be supplied by BHEL free of cost.
- All welders shall be tested and approved by BHEL Engineer before they are quality ensured on work though they may possess the requisite certificates. BHEL reserves the right to reject any welder without assigning any reason. The contractor will be responsible for the periodic renewal, retesting of the welders as demanded by BHEL statutory requirements.
- BHEL Engineer is entitled to stop any contractor ‘s welders from his work if his work is unsatisfactory for any technical reason or there is a high percentage of rejection of joints welded by him which in the opinion of BHEL Engineer, will adversely affect the quality of welding. Even though the welder has earlier passed the tests it does not relieve the contractor from his contractual obligations, to check the performance of the welders.
- Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor ‘s expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the quality engineer.
- The technical particulars, specifications and other general details of work shall be in accordance with PNAEG / BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.
- It shall be specifically noted that the employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.
- In case, any rework is required because of contractor's faulty erection, which is noticed during erection, the same has to be rectified by the contractor at his cost.
- It shall be the responsibility of the contractor to provide following category of workers in required numbers along with supervisors including necessary equipment, consumables, hand tools, etc. during this period. The rate quoted shall include all these contingencies also.

✓ Millwright Fitters
✓ Structural Welders
✓ Piping Welders
✓ Riggers
✓ Unskilled Workers
✓ Electricians
✓ Any other category of workers as may be required to complete job.

- PF Regn No: Labour License no: Workmen Insurance Policy no: to be obtained before start of work.
- The any safety penalties received from M/s NPCIL due to the non-safe operation of contractor will be debited back to back.
- PVC & ORC shall not be applicable.

- During initial erection of the piping work, depending upon the site condition/ demand some valves may be replaced with appropriate spool pieces as per the BHEL engineer instructions.
- Temporary material required during the erection of the piping supports will be provided by BHEL at free of cost. Manpower shall be engaged for cutting & shifting of temporary structure materials from BHEL yard to site.
- BHEL reserves the right to cancel the tender without assigning any reason.
- Receipt of free issue material, handling, transportation, uncarting, segregation of valves, preparation of IMIR, depreservation of valves, shifting to the required location, cleaning and visual inspection, erection of carbon steel and stainless steel valves of various diameters at various level, elevation & orientation as per drawings and technical specifications. This work also includes providing qualified man power, tools, tackles, erection of scaffolding, cleaning aids such as acetone etc., preparation reports and submission for NPCIL acceptance.

TENTATIVE SCOPE OF INCH DIA, INCH MTR

SL No	WD	BLD	Material	Inch Dia	Inch Mtr
1	R01.KK34.30UMA.QUG.TM.OK.WD001	3UMA	SS	473	750
2	R01.KK34.30UMA.QUC.TM.OK.WD001	3UMA	SS	1060	880
3	R01.KK34.30UMA.QUH.TM.OK.WD001	3UMA	SS	125	150
4	R01.KK34.30UMA.LCM90.TM.OK.WD001	3UMA	CS/SS	771	1050
5	R01.KK34.30UMA.LCM90.TM.OK.WD002	3UMA	CS/SS	3253	3600
6	R01.KK34.30UMA.QUA.TM.OK.WD01	3UMA	SS	156	140
7	R01.KK34.30UMA.QUB.TM.OK.WD01	3UMA	SS	239	70
8	R01.KK34.30UMA.JEA50.TM.OK.WD01	3UMA	SS	115	130
9	R01.KK34.30UMA.JEA50.TM.OK.WD02	3UMA	SS	68	50
10	R01.KK34.30UMA.LCS.TM.OK.WD01	3UMA	CS	145	90
11	R524.KK34.30UMA.LCS.TU.MC.WD02	3UMA	CS	72	90
12	R01.KK34.30UMA.LCT51.TM.OK.WD001	3UMA	CS	20	30
			TOTAL	**6497**	**7030**

*Note: The provided drawings are indicative only. To fulfil the complete scope of work and to address specific site requirements, additional drawings may be issued as necessary.

TENTATIVE SCOPE OF VALVES		
Sl No	**WD**	**Weight MT**
1	R01.KK34.30UMA.QUG.TM.OK.WD001	0.05
2	R01.KK34.30UMA.QUC.TM.OK.WD001	0.0919
3	R01.KK34.30UMA.QUH.TM.OK.WD001	0.0197
4	R01.KK34.30UMA.LCM90.TM.OK.WD001	0.165
5	R01.KK34.30UMA.LCM90.TM.OK.WD002	0.17
6	R01.KK34.30UMA.QUA.TM.OK.WD01	0.0184
7	R01.KK34.30UMA.QUB.TM.OK.WD01	0.084
8	R01.KK34.30UMA.JEA50.TM.OK.WD01	0.011
9	R01.KK34.30UMA.JEA50.TM.OK.WD02	0.121
10	R01.KK34.30UMA.LCS.TM.OK.WD01	0.121
11	R524.KK34.30UMA.LCS.TU.MC.WD02	0.271
12	R01.KK34.30UMA.LCT51.TM.OK.WD001	0
	TOTAL	**1.12**

Note-***** The weight of the valves for the billing will be considered based on the weight of the packing list provided by M/S NPCIL

TENTATIVE SCOPE OF SUPPORTS

SL No	WD	No of supports	Weight (MT)
1	R01.KK34.30UMA.QUG.TM.OK.WD001	299	1.31
2	R01.KK34.30UMA.QUC.TM.OK.WD001	2392	7.8
3	R01.KK34.30UMA.QUH.TM.OK.WD001	202	0.58
4	R01.KK34.30UMA.LCM90.TM.OK.WD001	425	0.908
5	R01.KK34.30UMA.LCM90.TM.OK.WD002	955	2.828
6	R01.KK34.30UMA.QUA.TM.OK.WD01	245	0.643
7	R01.KK34.30UMA.QUB.TM.OK.WD01	529	0.5632
8	R01.KK34.30UMA.JEA50.TM.OK.WD01	48	0.25
9	R01.KK34.30UMA.JEA50.TM.OK.WD02	28	0.216
10	R01.KK34.30UMA.LCS.TM.OK.WD01	52	0.09
11	R524.KK34.30UMA.LCS.TU.MC.WD02	12	0.11
12	R01.KK34.30UMA.LCT51.TM.OK.WD001	12	0.04
	TOTAL	**5199**	**15.34**

Note-*The quantities mentioned is tentative, the quantity may vary depending up on the site routing finalised by the customer, M/s NPCIL.

TENTATIVE SCOPE OF NDT

SL No	WD	RT Inch Dia	UT Inch Dia
1	R01.KK34.30UMA.QUG.TM.OK.WD001	60	0
2	R01.KK34.30UMA.QUC.TM.OK.WD001	200	0
3	R01.KK34.30UMA.QUH.TM.OK.WD001	30	0
4	R01.KK34.30UMA.LCM90.TM.OK.WD001	100	0

5	R01.KK34.30UMA.LCM90.TM.OK.WD002	320	0
6	R01.KK34.30UMA.QUA.TM.OK.WD01	40	0
7	R01.KK34.30UMA.QUB.TM.OK.WD01	72	0
8	R01.KK34.30UMA.JEA50.TM.OK.WD01	25	0
9	R01.KK34.30UMA.JEA50.TM.OK.WD02	20	0
10	R01.KK34.30UMA.LCS.TM.OK.WD01	50	0
11	R524.KK34.30UMA.LCS.TU.MC.WD02	25	0
12	R01.KK34.30UMA.LCT51.TM.OK.WD001	0	0
	TOTAL	**942**	**0.0**

TENTATIVE SCOPE OF COLD BENDING

SL No	WD	RT Inch Dia	
1	R01.KK34.30UMA.QUG.TM.OK.WD001	225	
2	R01.KK34.30UMA.QUC.TM.OK.WD001	380	
3	R01.KK34.30UMA.QUH.TM.OK.WD001	95	
4	R01.KK34.30UMA.LCM90.TM.OK.WD001	200	
5	R01.KK34.30UMA.LCM90.TM.OK.WD002	300	
6	R01.KK34.30UMA.QUA.TM.OK.WD01	180	
7	R01.KK34.30UMA.QUB.TM.OK.WD01	150	
8	R01.KK34.30UMA.JEA50.TM.OK.WD01	50	
9	R01.KK34.30UMA.JEA50.TM.OK.WD02	30	
10	R01.KK34.30UMA.LCS.TM.OK.WD01	0	
11	R524.KK34.30UMA.LCS.TU.MC.WD02	0	
12	R01.KK34.30UMA.LCT51.TM.OK.WD001	0	
	TOTAL	**1610**	

SOQ No.F2 - Welding of CS,SS pipe, Type-Butt Weld:

Handling, cutting, edge correction (for pipe spools issued with prepared edges), removal of paint from the joint area, cleaning, fit up, welding using GTAW/ SMAW process including hook-up joints, mechanical cleaning of weld joint, visual inspection, repair of welding if any, FME inspection as per manufacturer drawings, documents and specifications.

The scope includes joint identification & marking by engraving, preparation of welding inspection report (WIR), scaffolding & platforms, man power, welder qualification, P&M, tools & tackles, all consumables (excluding welding filler wire & electrode) etc.

Note: 1. Incase any temporary structures required, contractor shall arrange to fabricate and shift the temporary structural materials from BHEL yard to site as per requirement. Material shall be issued by M/s BHEL on returnable basis.

SOQ No.F2 - Welding of small bore CS piping:

Type-Butt Weld: Handling of pipe size ranging from 10 NB to 80 NB mm or 14 mm OD to 89 mm OD, cutting, removal of paint from the joint area, edge preparation, cleaning, fit up, welding using GTAW/ SMAW process including hookup joints, mechanical cleaning of weld joint, visual inspection, repair of welding if any, FME inspection as per manufacturer drawings, documents and specifications.

The scope includes site survey, joint identification & marking by engraving, preparation of welding inspection report (WIR), scaffolding & platforms, man power, welder qualification, scaffolding & platforms, man power, P&M, tools & tackles, all consumables (excluding welding filler wire & electrode) etc.

Note: 1. Incase any temporary structures required, contractor shall arrange to fabricate and shift the temporary structural materials from BHEL yard to site as per requirement. Material shall be issued by M/s BHEL on returnable basis.

SOQ No.4 - Welding of small bore SS piping Type-Butt Weld:

Handling of pipe size ranging from 4 NB to 80 NB mm or 6 mm OD to 89 mm OD, cutting, removal of paint from the joint area, edge preparation, cleaning, fit up, welding using GTAW/ SMAW process including hook-up joints, mechanical cleaning of weld joint, visual inspection, repair of welding if any, FME inspect ion as per manufacturer drawings, documents and specifications.

The scope includes site survey, joint identification & marking by engraving, preparation of welding inspection report (WIR), scaffolding & platforms, man power, welder qualification, P&M, tools & tackles, all consumables (excluding welding filler wire & electrode) etc.

Note: 1. Incase any temporary structures required, contractor shall arrange to fabricate and shift the temporary structural materials from BHEL yard to site as per requirement. Material shall be issued by M/s BHEL on returnable basis.

SOQ No.F8 - Erection of CS/ SS piping systems:

Identification of pipe spool, handling, cutting, erection and alignment of CS, SS & Ti piping along with accessories, at various elevations and locations, FME inspection, preparation of erection reports, as built drawings and work completion as per manufacturer drawings, documents and specifications with acceptance of EIC.

The scope includes providing temporary support arrangements, SS shims, scaffolding & platforms, man power, P&M, tools & tackles, all consumables (excluding welding filler wire & electrode) etc.

Note: 1. Incase any temporary structures required, contractor shall arrange to fabricate and shift the temporary structural materials from BHEL yard to site as per requirement. Material shall be issued by M/s BHEL on returnable basis.

SOQ No.F11 – Cold bending:

Where elbows not available for the pipelines of OD 57 mm and below, the contractor shall fabricate bends by cold bending as per the approved procedure and as instructed by the EIC. In addition to the general requirements , the contractor shall perform the following activities. Cold bending will be done using formed dyes, and with internal mandrels (where practical), to prevent flattening. Compression bending shall be used for thick wall pipes and for large radius bends, "Draw" bending shall be used for thin wall pipes and for small radius bends. The use of any filler material during bending is prohibited. Hot bending is not permitted, instead of that minor hot bending correction may be permitted as directed by the EIC. Any bending lubricants shall be subjected to approval of the EIC. Bend curvature shall be uniform and the surfaces shall be free from cracks, bulges, wrinkles, tooling damage and other injurious defects. Sample bends shall be prepared and examined after sectioning for conformance with thickness and ovality requirements. The entire external surfaces of all bends shall be inspected by liquid penetrant technique without separate measurement and payment. However for all the systems 100% visual inspection shall be carried out on all the bends.

SOQ No.F13 - Valve Testing (CS/SS/Ti):

Identification, de-preservation, handling, shifting of valves from contractor's stores/ erection site to contractor's valve testing facility, installation of valve on test bench, testing of valves, removal & shifting of valve to erection site after testing, preparation of reports including man power, P&M, scaffolding & platforms, tools & tackles with acceptance of EIC.

SOQ No.F14 - Erection of Valves (CS/SS/Ti):

Handling, de-preservation, identification, pre-assembly, installation in design position, erection of manual and electric operated valves, FME, box up, preservation, preparation of reports and carrying out all works as per manufacturer drawings, documents and specifications including temporary support arrangements, scaffolding & platforms, man power, P&M, tools & tackles, all consumables with acceptance of EIC.

SOQ No.F15 - Fabrication and erection of supports:

Identification and handling of various components of pipe supports, cutting, straightening, grinding, fabrication, fit up, welding with SMAW process, weld visual of joints and bolting.

Shifting of pipe supports to the location, assembly, alignment, pad welding by GTAW, tacking in position, welding of pipe support saddle and its support metal structure.

Spring height adjustment to the required value in cold condition, spring unit locking, pre-assembly of spring units, hangers, installation in design position, inspection/ checking of elevation, spring un it lock release after hydro test, preparation of reports and work completion as per manufacturer drawings, document s and specifications with acceptance of EIC.

The scope includes arrangement of SS shims, man power, temporary support arrangements, scaffolding & platforms, tools & tackles, P&M, consumables (excluding welding filler wire & electrode), cleaning aids etc. with acceptance of EIC.

Note: 1. Incase any temporary structures required, contractor shall arrange to fabricate and shift the temporary structural materials from BHEL yard to site as per requirement. Material shall be issued by M/s BHEL on returnable basis.

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 Uclamp, 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. 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. 3. Supply and fixing of anchor fasteners are through separate SOQR.

4. Supply and application of grit basting and painting on pipe support are through separate SOQR. 5. 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. 6. 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.

7. Type I: Spring Type Supports (F15.1): a. Single/Double spring hanger support: It consists of single/Double spring coil which supports the gravity loads of piping systems and is suspended by turn buckles attachment with concrete or steel structure. b. Spring with base support: It consists single-spring coil which supports the gravity loads of piping systems from below c. The pre

assembly work involves pre-compression and locking of spring unit height to set value of drawing, assembly, installation of spreader beam, pipe clamps, lock pad plates, saddles, turn buckles, and other ancillaries item, welding of pad plate, fabrication of support structures and its welding with embedded parts(EPs) in concrete or metal structures. 8. Type II: Rigid Hanger Supports (F15.2): In this type of support the piping is suspended by hanger rods rod attachment with concrete or steel structure. The erection work involves installation of spreader beam, pipe clamps, lock pad plates, saddles, turn buckles, and other ancillaries item, welding of pad plate and tie rod, fabrication of support structures and its welding with embedded parts(EPs) in concrete or metal structures. 9. Type III: Fixed/sliding/guide sliding/damper supports (F15.3): In these types of supports the piping is supported by saddle, mounted on supporting structure. The erection work involves installation of pipe clamps, lock pad plates, saddles, and other ancillary's item, welding of pad plate, fabrication of support structures and it's welding with embedded parts (EPs) in concrete or metal structures

SOQ No.F19 - Weld Joint Inspection by RT (Gamma Ray):

Identification of the weld joints, marking, radiographic examination of the weld joint including intersections by ISNT/ ASNT RT qualified personnel, developing of films, preparation of reports and submission to NPCIL for acceptance along with RT film, arrangement of man power, tools & tackles, plant & machinery, consumables, scaffolding & platforms, cleaning aids, storage of source etc. as per drawings, documents and specifications with acceptance of EIC.

SOQ No.F21 - Weld Joint Inspection by UT (Ultrasonic Test):

Identification of the weld joints, marking, pre-cleaning, ultrasonic examination of the weld joint including intersections by ISNT/ ASNT UT qualified personnel, post cleaning, preparation of reports and submission to NPCIL for acceptance including arrangement of man power, tools & tackles, plant & machinery, consumables, scaffolding & platforms, cleaning aids etc. as per drawings, documents and specifications as detailed in Sec V with acceptance of EIC.

SOQ No.F23 - Hydro/Pneumatic test of Piping System:

Making required arrangement on the erected pipelines for carrying out hydro/ pneumatic testing, blan king, filling of pipeline, venting, pressurising, holding for required time, draining, drying, de-watering ,cleaning, providing all required tools and tackles, blanks, hoses, clamps, calibrated PG, SRVs etc, preparation of as-built drawings, hydro-test scheme, CRR, test reports, arrangement of man power, tools & tackles, P&M, scaffolding & platforms, consumables(except welding electrode & filler wire), cleaning aids etc. as per drawings , documents, specifications and work completion with acceptance of EIC.

Note:

1. During testing of circuits, if leaks are observed, such circuits may need pressurization and testing more than once. Such re-testing and pressurization will be in the scope of the Contractor without any extra claim. 2.In case any temporary structures required, contractor shall supply all the materials including welding electrodes and consumables.

2. There are some systems which are partially erected which may also be included in the circuit of hydro test. In such cases, the clearance of such joints, rectification of weld defect of joints which was carried out by the other agencies will be cleared by M/s BHEL.

SOQ No.F24 - Preparation of isometric drawings for piping systems, its submission and approval:

Wherever flow sheets are only available but detailed drawings are not available, contractor shall prepare isometric drawings to suit the site conditions before start of fabrication and erection work as instructed by EIC. The scope includes study of system flow sheets, site survey, identification of pipe routing avoiding interferences, deciding support location based upon site constraints, identification of type of supports, support span, number of supports, support structure design, preparation of isometric drawing with details of supports and support drawing, weld joints, bill of material and submission of drawing to NPCIL for approval. The layout of piping and isometric drawing shall be prepared in such a way that the design requirements are fulfilled and the layout is optimized with minimum work and usage of material. All the required information such as co-ordinates, distance from grids, location, elevation, connecting nozzles, line number, support number, length of pipes, fitting details and weld details shall be provided in the drawing. The drawings shall be drafted using latest version of software such as AutoCAD in NPCIL acceptable format. Drawings shall be submitted in both hard copy and soft copy.

The measurement for preparation of isometric drawings will be in running meter of pipeline.

Note: This item will be operated if required only.

SOQ No.H9 - Removal of erected material:

In case of any modification required to be carried out during construction, the erected piping, valves, structures and supports may have to cut and removed as per the instructions of EIC. The work includes the activities of cutting, grinding, drilling, dismantling, removal, handling, shifting of pipes, valves, supports and storing in the identified location. While carrying out the removal activities care shall be taken not to damage the connected and nearby pipes and equipments. Scope includes arranging all necessary P&M, manpower, tools & tackles, consumables, scaffolding, return of removed material to NPCIL store and preparation of its reports etc and work completion.

SOQ No.L8.5 - Scaffolding:

In general the arrangement of scaffolding shall be part of the scope of work for all the SOQR items except for certain specific works such as Preservation, Prehanding over checks and repair works for which payment for scaffolding shall be through separate SOQR item with acceptance of EIC.. Scaffolding for the above specific works shall be erected at various elevations/locations for carrying out preservation/ Pre-handing over checks/repair works as per the instructions of EIC. The erection / dismantling of scaffolding and its hiring charges shall be measured separately in respective SOQRs. The scaffolding for specific works involves erection of scaffolding using standard MS pipes as vertical and horizontal members at spacing not more than 1.5 mapart including providing cross supports, along with MS clamps, making approach/ working platforms to carry out various activities, obtaining clearance from NPCIL safety and its dismantling after the

completion of work as instructed by EIC. All the scaffoldings shall be appropriately tagged with safe or unsafe for use instructions. The scope includes arrangement of man power, tools & tackles, P&M & consumables. The hire charges for the scaffolding for the above specific works will be measured in m 3 xday in such a way that the number of days for rent will be considered from the next day of completion of erection & clearance by NPCIL safety department & up to date clearance (inclusive) from EIC for dismantling. The scaffolding base in m 2 & height in meter erected shall be considered for the measurement of volume. Inclined supports, lateral support bracing etc projected beyond base size shall not be considered in measurement for payment. Material required for scaffolding viz. pipes, clamps, base plate, platform, ladders, shifting etc shall be provided by contractor. However if during the course of use of scaffoldings (after getting clearance by NPCIL safety department) if the same is found unsafe or without inspection tags or found with missing scaffold members/approach ladders etc , the rental charges will not be paid for such time duration till the deficiencies are corrected and clearance is obtained.

SOQ No.L9.3 - Insitu Modification works:

Modification work at site involving cutting and welding operation shall be carried out as per the issued drawings/ sketches with approval of EIC. The scope of work involves identification, handling, marking, cutting and edge preparation, fit-up, longitudinal seam/ groove welding of components, grinding, cleaning, visual inspection, disposal of removed materials at NPCIL store, preparation of reports. The work includes arrangement of manpower, P&M, tools & tackles and consumables (excluding electrode) and completion of work as per the instructions of EIC. The cutting work shall be carried out by oxy acetylene flame cutting or grinding machine. All the gas cut edges shall be finished by grinding. Welding shall be done by SMAW process

Calculation of weld volume for butt/groove welds. The Welded butt/ groove joints shall be measured by volume of weld geometry in units of Cubic Centimeter (CC).The cross-section of joint configuration can be single/double V groove, single/double bevel etc. The volume of weld geometry will be measured during fit-up stage according to the joint configuration including the reinforcement volume. The volume of weld due to fusion will not be taken into account for weld volume calculation.

Shifting of Materials:

Painted materials from M/s BHEL yard/stores to site to be shifted by the contractor. No additional payment will be considered. Schedule of requirement shall be intimated to M/s BHEL atleast 15days in advance for issuing the materials (BHEL scope: material shifting from M/s NPCIL to M/s BHEL yard and painting works). Contractor shall provide assistance for IMIR of the materials shifted from M/s NPCIL to M/s BHEL.

GENERAL REQUIREMENTS:

1. The pipe lines shall be erected by the contractor as per the working Drawings and documents issued by NPCIL.
2. The scope of work of pipeline covers free issue material issued by NPCIL
3. Secondary Cycle Pipe lines shall be erected at various locations and elevations of UMA, UMV.

4. The term "Pipe Line" shall comprise all pipes, pipe fittings, pipe supports and its supporting structure, level gauges, thermowells, pressure tap bosses, 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 equipment, reinforcing pads for branch connections, valves, valve operators, strainers, traps, flow elements, flanges, gaskets, nuts, bolts, expansion joints, orifices, venturimeter, 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, but excluding wiring of motorized valves and instrument tubing (other than process tubing) from the isolation valves to manifold shall be considered part of piping.
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.
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.
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 in big bore pipelines, the same shall be done by the contractor as part of pipe welding work.
8. For any cutting and edge preparation of big bore pipelines required to suit the layout of piping, the same will be operated as per SOQ. However, for all the small bore pipes and fittings (upto 80 NB) contractor shall make edge preparation as part of pipe welding work.
9. Care shall be taken to prevent damage of coating while handling, shifting and erection of pipeline.
10. Adherence to safety guidelines, security guidelines, various work permit system and compliance of all statutory requirements of the project.
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, equipment, etc.
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 contractors at his own cost. After completion of weld joint the open edges of pipes shall be fitted with temporary plastic /steel caps.
13. Contractor shall follow all the work procedures with reference to applicable codes and standards WPS, PQR for the pipe welding and qualification of welders.
14. Preparation of reports, documents required at various stages of the work.
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.
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.

Fabrication and welding of CS, SS pipelines:

In addition to the requirements given above, the contractor shall perform the following activities.

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.
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.
3. NPCIL will supply of various electrodes and filler wires for welding of CS/SS pipes. Contractor shall prepare material accounting for receipt, consumption, wastages and return of electrodes and filler wires and submit to BHEL/NPCIL.
4. Welding of pipelines will be measured in Inch-dia for CS, SS.

Erection of CS, SS pipelines

In addition to the general requirements given above, the contractor shall perform the following activities.
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.
2. Providing temporary supports for erection of pipelines.
3. Fixing of pressure & temperature stubs, rotameter, venturies and orifice flanges as per the specifications.
4. Welding of the above stubs as per WDs
5. Drilling on stubs or on pipelines as per WDs
6. Site bending for small bore lines
7. Erection of pipelines will be measured in Inch-m as common item for CS, SS

Welding requirements
1. Work shall be carried out as per approved WPS, PQR only.
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.
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.

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.

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.

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 NPCIL. All the reports shall be generated and maintained by the contractor.

7. The welding technique and arc manipulation shall be controlled to ensure the following:

a. Full Penetration for groove welds.

b. Full fusion into the preceding bead or layer.

c. Full fusion into the base metal without undercutting along the sides of the weld.

d. Uniformity of surface in both single run passes and beaded layers.

e. Floating all slag, oxide and gases to the surface behind the advancing arc.

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.

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.

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).

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.

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.

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.
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.
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.
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. Sea water pipe lines are to be coated with anti-corrosive coating on the internal surfaces of the pipe line and in some cases on external surfaces also by Contractor. Hence the weld profile shall be ground smooth without rough edges, sharp corners and spatters, under cuts etc also shall be removed.
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.
17. **Seal welds:** Seal welding shall be done by qualified welders and in accordance with approved procedures. Threaded joints that shall be seal 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.
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.

Welding materials:

Welding materials intended for welding of 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 the 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 УОНИИ -13/45, УОНИИ -13/55,
E42A; filler wire Сб08г2С

b. for welding of corrosion-resistant steel, 08X18H10T, 12X18H10T – electrodes EA-400/10Y, EA-400/10T filler wire Сб -04X19H11M3
c. For different steels (carbon + corrosion-resistant) – electrodes EA-395/9, filler wire Сб-10X16H25AM6.

d. For titanium pipe welding, special electrodes and filler wires materials as specified in manufacturers drawing and documents.

Welding process:
The contractor may use following welding technologies
1. Manual arc welding with coated electrodes (SMAW);
2. Manual argon-arc welding with non-consumable (tungsten) electrodes (TIG/GTAW welding);
3. Automatic argon-arc welding
4. Combined welding (bottom run by argon-arc welding; hot pass and final run by manual arc welding).
5. For HDPE pipes fusion welding.

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. 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.
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.
3. If preheat is specified in the appropriate welding procedure then the same preheat must be maintained during flame outing or arc gouging.
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.
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.
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.
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.
8. Repairs of any base material utilized in fabrication of piping shall not be undertaken unless specifically permitted by the Quality Surveyor.
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.

Electrode storage, control & monitoring:
Contractor shall be responsible for storage, baking, control, calculation and monitoring of electrodes as detailed below.

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 +200 C and not more than 500 C. The relative humidity of room should not exceed 50%. Electrodes of different equipment shall be identified till they are consumed. Dehumidifier room will be provided by M/s BHEL.
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 4000 C. The baked electrode to site should be stored in a transfer oven to 1500 C to 2000 C. Electrode to site should be sent only through portable oven with heating range of 1000 C and above. Electrode should never be taken to site without ovens.
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 14days.As soon as particular work is completed, the reconciliation of electrodes should be submitted and records to be maintained.
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.

Erection of valves:
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.

Fabrication and erection of pipe supports:
The Contractor scope of work shall comprise the following:
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.

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.
3. Supply and fixing of anchor fasteners if required will be arranged by M/s BHEL.

4. Supply and application of grit basting and painting on pipe support will be arranged by M/s BHEL.

5. 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.
6. Where CS supports are used for S.S. pipe, S.S. shim sheet shall be used between pipe and support clamp, and supply in BHEL scope whereas cutting of shims is part of scope of work.

Type I: Spring Type Supports:

a. Single/Double spring hanger support: It consists of single/Double spring coil which supports the gravity loads of piping systems and is suspended by turn buckles attachment with concrete or steel structure.
b. Spring with base support: It consists single-spring coil which supports the gravity loads of piping systems from below
c. The pre assembly work involves pre-compression and locking of spring unit height to set value of drawing, assembly, installation of spreader beam, pipe clamps, lock pad plates, saddles, turn buckles, and other ancillaries item, welding of pad plate, fabrication of support structures and its welding with embedded parts(EPs) in concrete or metal structures.

8. **Type II: Rigid Hanger Supports:**

In this type of support, the piping is suspended by hanger rods rod attachment with concrete or steel structure. The erection work involves installation of spreader beam, pipe clamps, lock pad plates, saddles, turn buckles, and other ancillaries item, welding of pad plate and tie rod, fabrication of support structures and its welding with embedded parts(EPs) in concrete or metal structures.

9. **Type III: Fixed/sliding/guide sliding/damper supports:**

In these types of supports the piping is supported by saddle, mounted on supporting structure. The erection work involves installation of pipe clamps, lock pad plates, saddles, and other ancillary's item, welding of pad plate, fabrication of support structures and it's welding with embedded parts (EPs) in concrete or metal structures.

Stub/o-let drilling :

Stub/O-let drilling involves study of drawings, identification of pipe spools and Olets/ stubs, handling, shifting the pipe spools, drilling of primary 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. The UOM for drilling is cubic-cm measured as effective volume of the drilled hole or enlarged hole.

Non-destructive examination (NDE) :

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:

1. Visual:

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

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 NPCIL for acceptance including arrangements of equipments, manpower, tools tackles materials & consumables and completion of work as per the tender 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.

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 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 penetrameter by machining.

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 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 for RT using X-ray equipment.

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 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.

Hydro/pneumatic testing :

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. The hydrostatic/pneumatic testing shall be carried out circuit by circuit by suitable blanking. The testing pressure varies up to 21 MPa. Under peak period contractor shall mobilize sufficient resources and testing pumps to complete the hydrostatic/pneumatic test within the scheduled period in order to hand over the system.

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

Preparation of CRR (Circuit Release Report) for hydrostatic/pneumatic testing of the pipelines 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. **Preparation of As built drawings :** As built drawings shall be prepared and submitted after completion of erection.

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.

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. Arrangement of DM/Clean filtered water with required quality for hydro testing. Arrangement of Compressed Air or nitrogen cylinders for pneumatic testing.

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

c. 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.

d. 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.
e. 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.
f. Oil system shall be tested pneumatically or hydraulically using system oil (oil issued as FIM)
g. Co-ordination with various agencies and performing hydro/pneumatic test, preparation of final test reports.

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. **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.
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.
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 NPCIL.

2. TENTATIVE TOOLS & PLANTS REQUIRED

SUGGESTIVE P&M LIST

S.no	Description of Equipment	Qty (nos.)
	Welding	
1	Welding machine	As required
2	High frequency TIG welding machine	As required
3	Pipe chamfering machine	As required
4	Pipe bending machine	As required
5	Grinding Machine	As required
6	Mother oven	As required
7	Portable oven	As required
8	Holding oven	As required
9	Gas cutting set	As required
10	Fitter tool kit	As required
11	Engraving machine	As required
	MHE and load carrier	
12	Hydra 12/14/23	As required
13	Electric winch 10T	As required
14	Trailer 40 Feet	As required
15	Tata Ace HT/ Tata 407	As required
	Rigging	
16	Hydraulic jacks	As required
17	Chain pulley block (Upto 20 T)	As required
18	Wire rope slings	As required
19	Web sling	As required
20	D- shackle	As required
21	Bow shackle	As required
22	Eye bolt	As required
23	Manila rope	As required
24	Skid roller	As required
	Testing and Measurements	
25	Vernier calipers	As required
26	Weld gauges	As required
27	Profile gauge	As required
	Miscellaneous	
28	Vacuum cleaner	As required
29	Scaffolding set	As required
30	Lux Meter	1
31	Air Blower	As required
32	Fire extinguishers	As required
33	PPEs	As required

3. TENTATIVE MANPOWER REQUIRED

SL No	Description	No	Remark
1	Safety Officer + Supervisor	1+1*	Mandatory & As required per shift
2	Execution Supervisor	2	
3	Quality Supervisor	1*	As required
4	Signal Man	1	As required
5	Trailer Operator	1	As required
6	Hydra Operator	1	As required
7	Fitter	8-15*	*As required
8	Riggers	10-15*	*As required
9	Scaffolders	4-10*	*As required
10	Welders	4-8*	*As required
11	Helpers	8-15*	
12	Grinder	4-6*	*As required
	Total (tentative)	**45-76***	**As required**

Note: Applicable medical certificates & authorisation shall be completed before engaging the manpower for the work.

* Manpower requirement mentioned is tentative. Required category of manpower shall be deployed as per the site requirement for completion of work.

PF compulsory for the deployed labours

Labour licence compulsorily required.

BOCW/CESS applicable as per statutory rules.

4. MOBILISATION

T&Ps and manpower shall be deployed within 30 days of receipt of work order. Gate passes, Fitness certificates, material handling permit, NPCIL safety & security rules etc. shall be taken care in advance to avoid any delay.

5. CONTRACT PERIOD

- The date of mobilisation of all required T&P and manpower at site which is mutually agreed with the BHEL Engineer will be considered as the start date/commencement period. Earliest start desired.
- **Contract period shall be 08 months (Eight Months) from the date of commencement of the Work.**
- Rate will be firm throughout the contract period.

6. SITE FACILITIES:

6.1 LAND FOR SITE OFFICE

6.1.1 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 at the job site to be in the scope of contractor.

6.1.2 BHEL shall not provide to the contractor any residential accommodation to any of their staff and the contractor has to make their own arrangements.

6.1.3 Location and area requirement for office / storage sheds shall be discussed and mutually agreed to.

6.2 ELECTRICITY:

Construction power will be provided to the contractor at one point within plant area by BHEL **on chargeable basis** at the applicable rate of TANGEDCO under LT tariff at the nearest substation.

The present LT tariff VI rate of TANGEDCO is

a) Consumption charges: The prevailing rate of TANGEDCO is Rs.12.00 per unit
b) Fixed charges as applicable per month
c) Electricity Tax on total amount

The TANGEDCO tariff and tax may vary from time to time. The required Energy meter for measuring the consumption shall be provided and installed by the contractor. 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 armoured Power cable and MCB distribution boards.

Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor. Contractor to maintain log sheet with BHEL engineering in charge signature for weekly/ monthly power consumption and healthiness of ELCB.

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.

The required energy meter for measuring power consumption shall be arranged and taken care by Contractor

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.

Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.85-0.9 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.

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.

6.3 CONSTRUCTION WATER

Construction water if required any shall be arranged by the Contractor at their cost from outside of KKNPP.

6.4 DRINKING WATER:

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

6.5 LIGHTING FACILITY:

Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre assembly yard and contractor's material storage area etc. at their cost.

7. SECURITY DEPOSIT (SD), RETENTION AMOUNT & BANK GUARANTEE (BG):

- 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 5% of the contract value.
- **100% security Deposit** should be furnished **before start of the work** by the contractor.

The required Security Deposit of 5% of the contract value may be accepted in the following forms.

1. Cash (as permissible under the extant Income Tax Act).
2. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL
3. Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL).
4. Bank Guarantee from Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats
5. Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL)
6. Insurance Surety Bonds

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

In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate +4%) for the delayed period, shall be submitted by the bidder

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 include interest (Repo rate + 4%) 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.

In case the value of work exceeds the awarded / accepted value, the Security Deposit shall be correspondingly enhanced as given below

The enhanced part of the Security Deposit shall be immediately deposited by the Contractor or adjusted against payments due to the Contractor.

Contract value for the purpose of operating the increased value of Security Deposit due to Quantity Variation, shall be exclusive of Price Variation Clause, Over Run Compensation and Extra works done on Man-day rates.

The recoveries made from running bills (cash deduction towards balance SD amount) can be released against submission of equivalent Bank Guarantee in acceptable form, but only once, before completion of work, with the approval of competent authority of BHEL.

The validity of Bank Guarantees towards Security Deposit shall be initially up to the completion period as stipulated in the Letter of Intent/ Award + Guarantee Period + 3 months, and the same shall be kept valid by proper renewal by the contractor till the acceptance of Final Bills of the Contractor by BHEL.

BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfil any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

BANK GUARANTEES Where ever Bank Guarantees are to be furnished/submitted by the contractor, the following shall be complied with

i) Bank Guarantees shall be from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. Bank Guarantees issued by Co-Operative Banks/ Financial Institutions shall not be accepted.

ii) The Bank Guarantees shall be as per prescribed formats.

iii) It is the responsibility of the bidder to get the Bank Guarantees revalidated/extended for the required period as per the advice of BHEL Site Engineer / Construction Manager. BHEL shall not be liable for issue of any reminders regarding expiry of the Bank Guarantees.

iv) In case extension/further extensions of any Bank Guarantees are not required, the bidders shall ensure that the same is explicitly endorsed by the Construction Manager and submitted to the Regional HQ issuing the LOI/LOA.

v) In case the Bank Guarantees are not extended before the expiry date, BHEL reserves the right to invoke the same by informing the concerned Bank in writing, without any advance notice/communication to the concerned bidder.

vi) Bidders to note that any corrections to Bank Guarantees shall be done by the issuing Bank, only through an amendment in an appropriate Non- judicial stamp paper.

vii) The Original Bank Guarantee shall be submitted to Subcontracting Department of the respective Region of BHEL.

Electronic Fund Transfer the details are as below

a) Name of the Beneficiary:	Bharat Heavy Electricals Limited
b) Bank Particulars	
i). Bank Name:	State Bank of India
ii). Bank Telephone No. (with STD code):	044 – 29530724,044-29530803
iii). Branch Address:	SBI SME Guindy Branch 004327, No 65-A, G.S.T.ROAD,GUINDY,CHENNAI, TAMILNADU-600032.
iv). Branch Code:	04327
v). MICR Code of the Bank Branch:	600002114
vi). Bank Account Number:	10610819499
vii). Bank Account Type:	Cash Credit Account
viii). IFSC Code of Beneficiary Branch:	SBIN0004327
ix). Details for SFMS (Structured Financial Messaging System) transmission of BG.	
Bank and Branch:	SBI TFCPC Branch
Branch Code:	5056
IFSC Code:	SBIN0005056

- **RETENTION AMOUNT:**

Retention amount shall **be 5%** of the contract value and shall be furnished through BG in line with BG guarantee clause **before payment of the first RA bill**. The validity of the said BG shall be initially for the contract period & shall be extended, if so required, up to acceptance of the final bill. In case of an increase in contract value, additional BG for 5% of the differential amount shall be submitted by the contractor before the payment of the next RA bill due.

Retention amount can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the amount of the required retention amount is collected.

In case, contractor opts for cash deduction from RA bills in the beginning & subsequently offers to submit BG late on, then refund of the deducted retention amount may be permitted against submission of BG for 5% of the contract value.

REFUND OF RETENTION AMOUNT shall be as follows: -

- 100% of Retention Amount/ BG against Retention Amount shall be released along with Final Bill after deduction all expenses/ other amounts due to BHEL under the contract/ other contracts entered into with them (contractor) by BHEL.

8. TERMS OF PAYMENTS

- Stage Payment as per Annexure.

9. DOCUMENTS REQUIRED FOR PAYMENT

- Original tax invoice in duplicate.
- GST remittance proof.
- Statutory documents like wage register along with attendance sheet (minimum wages criteria to be strictly followed), bank payment proof of disbursement of wages to labour, EPF registration certificate, EPF challan, ESI registration certificate, ESI challan, WC for those not covered under ESI etc. (previous month of Work Done).

10. GST DETAILS & ADDRESS

BHEL SITE OFFICE
2X1000MW KKNPP - UNIT 3&4
KUDANKULAM P.O
RADHAPURAM,
TAMILNADU – 627106
GSTIN NO: 33AAACB4146P2ZL

11. OTHER TERMS & CONDITIONS

- Labour licence compulsorily required
- All labours to be covered under PF even if exemption is there as per rules
- Min wages criteria as per NPCIL circular shall be strictly followed as per rules
- Statutory documents submission compulsory (wage register, PF,ESI/WC policy)
- Work permit before start of work to be ensured.
- NPCIL safety rules to be strictly followed.
- Gate pass of all manpower and T&Ps to be made in prior (police verification/clearance certificate, medical certificates, Aadhaar card, self-declaration certificates etc. compulsorily required).
- Temporary shed/container to be arranged for safe storage of T&Ps.
- Open Space for shed/container, if required, shall be allocated by BHEL/NPCIL
- GST compliance compulsory.
- Accommodation & transportation of manpower shall be in contractor scope.
- Any variation in statutory laws to be followed.
- Any variation in the taxes and duties shall be followed as applicable.
- Urinal arrangement for the staff/work men to be arranged.

- Required PPEs to be arranged.
- If the work affected due to non-availability of manpower/T&P by the contractor, BHEL will arrange the same and the cost incurred towards the same will be deducted from the Bills.
- TERMINATION OF CONTRACT ON DEATH: Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the accepting officer shall have the option of terminating the contract without compensation to the contractor's authorized survivors.
- SECRECY OF CONFIDENTIAL INFORMATION: The bidder(s)/contractor agree & acknowledge that in the course of their discussions and interaction, BHEL may disclose information of confidential proprietary nature relating to its business, products, know-how, technology, customers, employees and financial to the bidder(s)/contractor. Such information shall be considered as confidential. The contractor agrees to keep it confidential & secret at all times and not directly or indirectly disclose to any party other than its employees and authorized personnel's strictly on a need know basis, without the prior written permission of BHEL.
- **SETTLEMENT OF DISPUTES**

  CONCILIATION: If at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, execution, effect, interpretation or breach of the Contract, which the Parties are unable to settle mutually, arise inter-se the Parties, the same may be referred by either Party to Conciliation to be conducted through Independent Experts Committee (IEC) to be appointed by competent authority from the BHEL Panel of Conciliators. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration & Conciliation Act, 1996 or any statutory modification thereof and as provided in the BHEL Conciliation Scheme as applicable from time to time.
- **ARBITRATION:**

  In case amicable settlement is not reached between the Parties, in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the sole arbitration of an arbitrator appointed by BHEL . The Arbitrator shall pass a reasoned award and the award of the Arbitrator shall be final and binding upon the Parties. Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be CHENNAI. The cost of arbitration shall be borne as per the award of the Arbitrator. Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

- APPLICABLE LAWS AND JURISDICTION OF COURTS: Indian laws both substantive and procedural, for the time being in force, including modifications thereto, shall govern the Contract including Arbitration proceedings. Notwithstanding any other court or courts having jurisdiction to decide the question(s) forming the subject matter of the reference if the same had been the subject matter of a suit, any and all actions and proceedings arising out of or relative to the contract shall lie only in the court of competent civil jurisdiction in this behalf at CHENNAI and only the said Court(s) shall have jurisdiction to entertain and try any such action(s) and/or proceeding(s) to the exclusion of all other Courts.
- DEFAULT/BREACH OF CONTRACT, INSOLVENCY AND RISK PURCHASE
  If the Service Provider / Contractor fails to provide the required services as per the Contract / fails to deliver the goods or materials or any instalment thereof within the period(s) fixed for such delivery or delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications or at any time repudiates or otherwise abandons the contract before expiry of such period or refuses or is unable to supply / provide goods / services or materials covered by the Order/Contract either in whole or in part or otherwise fails to perform the Order/Contract or commits any breach of the Order/Contract not herein specifically provided for or in the event of the death or insanity or if the Seller/Contractor being an individual or if a firm on a partnership thereof, shall at any time, be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the Order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act or if the Seller/Contractor(Service Provider) being a company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances shall have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager, the purchaser without prejudice to his right to recover any expenses, losses or damages to which the purchaser may be put to incur or sustain by reason of the Seller/Contractor's default or breach of Order/Contract shall be entitled to cancel the Order/Contract either in whole or portion thereof without compensation to the Seller/Contractor(Service Provider) and if the purchaser so desires, he may procure upon such terms and in such manner as he deems appropriate, stores not so delivered or others of a similar description where stores exactly complying with particulars are not, in the opinion of the purchaser, which shall be final, readily procurable, at the risk and cost of the Seller/Contractor(Service Provider) and the Seller/Contractor(Service Provider) shall be liable to the purchaser for any excess costs provided that the Seller/Contractor(Service Provider) shall continue the performance of the Order/Contract to the extent not cancelled under the provisions of this clause. The Seller/Contractor (Service Provider) shall on no account be entitled to any gain on such repurchases.

  Cost of the purchases/service made by the Purchaser/Service taker at the risk and cost of the

  seller/Contractor (Service Provider) shall be worked out after levying 30% overheads as departmental charges on the cost of materials / services so purchased/hired.
- FORCE MAJEURE
- A Force Majeure (FM) means extraordinary events or circumstance beyond human control such as an event described as an Act of God (like a natural calamity) or events such as war,

strike, riots, crimes (but not including negligence or wrong-doing, predictable/seasonal rain and any other events specifically excluded in the clause). An FM clause in the contract frees both parties from contractual liability or obligation when prevented by such events from fulfilling their obligations under the contract. An FM clause does not excuse a party's non-performance entirely, but only suspends it for the duration of the FM. The firm has to give notice of FM as soon as it occurs and it cannot be claimed expost facto. There may be a FM situation affecting the purchase organization only. In such a situation, the purchase organization is to communicate with the supplier along similar lines as above for further necessary action. If the performance in whole or in part or any obligation under this contract is prevented or delayed by any reason of FM for a period exceeding 90 (Ninety) days, either party may at its option terminate the contract without any financial repercussion on either side. Notwithstanding the punitive provisions contained in the contract for delay or breach of contract, the supplier would not be liable for imposition of any such sanction so long as the delay and/or failure of the supplier in fulfilling its obligations under the contract is the result of an event covered in the FM clause.

- TAXES & DUTIES:

✓ To enable BHEL to avail GST Input tax credit, Contractor shall submit GST compliant tax invoice containing all the particulars as stipulated under Invoice Rules of GST Law.

✓ Payment shall be made to the Contractor only after submission of GST complaint Tax invoice. The Contractor shall raise GST compliant invoice affixing GSTIN of BHEL.

✓ 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 service contract the GST rate shall be @ 18%, as applicable presently.

✓ BHEL reserves the right to protect its interest against any loss on account of availability of GST credit.

✓ GSTIN of BHEL will be provided to the Contractor along with the work order.

✓ 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.

✓ Applicable GST shall also be recoverable from the Contractor in case of LD recovery/penalty on account of breach of terms of contract.

✓ Invoice submitted should be in the format as specified under GST Laws viz. all details as mentioned in Invoice Rules like GSTIN registration number, invoice number, quantity, rate, value, taxes with nomenclature – CGST, SGST, IGST mentioned separately, HSN (Harmonized System of Nomenclature) Code / SAC (Services Accounting Code) Code etc.

✓ 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.

✓ 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.

✓ 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. Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST

law and comply to the timelines for issue of the same. Invoices shall be submitted on time to BHEL.

- ✓ 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.
- ✓ 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.

- **PENALTIES AND FINE:**

- ✓ "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: ₹10,00,000/- (Rupees Ten Lakhs)

  (ii) In the event of other permanent disability: ₹7,00,000/- (Rupees Seven Lakhs)

  d) 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."
- ✓ The Contractor SHALL Indemnify and keep BHEL indemnified against any loss/claim which is brought against BHEL by third party on account of any negligence of the contractor or his workforce, while carrying out the services under the contract.
- ✓ NOTWITHSTANDING ANYTHING ABOVE, BHEL shall recover from the Contractor for any loss suffered by BHEL due to any negligence of the contractor or his workforce, while carrying out the services under the contract.
- ✓ DELAY IN DISBURSEMENT OF MONTHLY WAGES: Service provider agrees and undertakes that it shall disburse monthly wages to the concerned workman in a timely manner without fail {as mentioned in SLA). Similarly, the Service provider shall credit the contribution towards the Employees Provident Fund, Employees' Pension Scheme, Workmen Compensation etc. for its workmen within the stipulated timeline provided in the respective statutes. No excuses (whatsoever reason may be) on this account i.e. "delaying disbursement of monthly wages" will be entertained by BHEL during the entire contract period. If BHEL becomes aware of any delays in making wage/salary payments by Service provider to its workmen, BHEL may also consider to terminate the Contract apart payment from which BHEL reserves the right to impose fines (Taxes extra) for an amount equivalent

to the 0.5% of the delayed for each day delay in payment of wages/salary but not exceeding 10% of the delayed amount. BHEL decision in this regard shall be final & binding in this regard. Further, apart from the foregoing, the Service provider will indemnify and keep BHEL indemnified against any losses, damages, claims etc. caused to BHEL for any default on the part of the Service provider in complying with the provisions of Labour Laws as required to be complied with from time to time.

- ✓ All amounts including the losses / damages / penalties / compensations etc., resulting from non-compliance with the terms of Contract, payable by the Service provider to BHEL under the Terms of the Contract will be recovered from the outstanding payments to Service provider either under this Contract or any other Contract with BHEL or from Security Deposit or from both. In case this amount is insufficient for such recoveries, the Service provider shall make good the balance amount by actual payment. In addition, BHEL will recover the said amounts through its sister concerns, from the payments due to the Service provider in any of the Units of BHEL located in any part of India.

12. STATUTORY REQUIREMENTS

- Kudankulam Nuclear Power Project is guided by Central government rules and regulations. Contractor shall comply all statutory regulations of State / Central Governments and NPCIL like Pradhan Mantri Rojgar Protsahan Yojana (PMRPY) scheme, Pradhan Mantri Garib Kalyan Yojana (PMGKY) scheme etc. Any guide lines / orders/notifications/ circulars issued by statutory body of both central /state governments and NPCIL from time to time is applicable for this contract. 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
- Rates of EPF / EPS / EDLI / ESI / Min. Monthly Bonus etc. (subsequent to floating of this tender), as & when notified by Governing Statutory Authorities will be applicable in the contract.
- Components of Wages / Statutory Payments (i.e. Rates of Minimum Wages, Rates of
- Contribution by Employer & Employee towards EPF and ESI, Rates of Contribution by Employer towards Bonus, Number of Encashable Leaves etc.) are subject to amendments as & when promulgated from time to time by respective statutory authorities / appropriate government.
- The Contractor will pay the minimum wages as per relevant provisions of Minimum Wages Act, 1948 (i.e. Respective State Govt. notified Minimum Wages) along with BHEL additional payment / cash component of Rs. 3200/- and Rs. 4100/- for Unskilled and Skilled Category of workforce respectively.
- Increase of Basic & VDA as & when notified by NPCIL (subsequent to floating of this tender) be incorporated in the monthly wage calculation and any further increase of VDA will become the part of monthly consolidated wages.
- All payments to the contractor's workforce (so engaged for deployment under this contract) shall be as per the terms of contract.
- Every contractor shall issue wage slips, to the workmen at least a day prior to the disbursement of wages. The Wage slip must bear the Contractor's name & logo etc. The 'Wage Slip' must also mention clearly the Name & ID of individual, all the wage components.

- Besides, UAN, PF Account No., ESI Account No., all other relevant details must also be mentioned on the 'Wage Slip'. The Contractor will be responsible for Maintenance of records / exhibiting of notices / issue of wage slips etc.
- The contractor shall fix wage periods in respect of which wages shall be payable.
- No wage period shall exceed one month.
- Where an any member of Contractor's workforce deployed at BHEL-premises has been (i) removed or dismissed from service by the Contractor; or (ii) retrenched or has resigned from service, the wages payable to him shall be paid by the Contractor within Five working days of his removal, dismissal, retrenchment or, as the case may be, his resignation.
- All payments of wages shall be made on a working day and during the working time and on a date notified in advance.
- Notwithstanding anything contained in any other law for the time being in force, there shall be no deductions from the wages of the employee, except those as are authorized under the code for payment of wages.
- Contractor shall be responsible for making payment of wages before the expiry of 7th day after the last day of wage period in respect of which wages are payable and to ensure disbursement of wages. The representative of contract operating division shall record under his signature at the end of entries in the Registrar of Wages confirming the above
- MODE and TIME FOR PAYMENT OF WAGES: The Contractor shall make the disbursement of wages to all the workforce in a suitable applicable mode (primarily by electronic mode) but strictly not in cash and inform BHEL electronically the amounts so paid along with their respective mode of transaction. The Contractor shall fix wage periods in respect of which wages shall be payable. No wage period shall exceed one month. The contractor shall pay or cause to be paid wages to their workforce (deployed at BHEL premises), engaged on monthly basis, before the expiry of the seventh day of the succeeding month. Any delay on this account (i.e. delay in disbursement of monthly wages) may results into penalty or termination of Contract.
- BONUS: The contractor shall be liable to pay statutory bonus under THE PAYMENT OF BONUS ACT 1965 or any other law time being enforced and submit proof of disbursement of bonus. The contractor shall ensure the payment of Min. Bonus @ 8.33% as per Payment of Bonus Amendment Act 2015. Same is applicable for the Wages up to ₹21,000/-. As per Bonus Amendment Act-2015, bonus is to be computed on ₹7,000/- or the minimum wage for the scheduled employment, as fixed by the Appropriate Government, whichever is higher. The contractor shall strictly comply with the provisions of THE PAYMENT OF BONUS ACT 1965 and THE PAYMENT OF BONUS AMENDMENT ACT-2015. The Contractor has to disburse the payment of Bonus to their workforce within a period of eight months from the close of the accounting year and submit proof of payment of bonus in Form– C and Form–D under the Act to BHEL. Payment against Min. Bonus shall be made to the contractor when the contractor submits proof of such payment.
- The Contractor shall comply with the provisions of the PAYMENT OF WAGES ACT, 1936 or any other law time being enforced in respect of all workforce employed by him in the services/works. If in compliance with the terms of the contract, the Contractor shall supply any workforce to be used wholly or partly under the direct orders and control of BHEL whether in connection with the works to be executed hereunder or otherwise for the purpose of BHEL, such workforce shall nevertheless be deemed to comprise persons employed by the contractor and any moneys which may be ordered to be paid by BHEL shall be deemed to be money payable by BHEL on behalf of the Contractor and BHEL may

on failure of the Contractor to repay such money to BHEL deduct the same from any money due to the Contractor in terms of the contract. BHEL shall be entitled to deduct from any money due to the contractor (whether under this contract or any other contract) al money paid or payable by BHEL by way of compensation of aforesaid or for costs of expenses in connection with any claim thereto and the decision of BHEL upon any question arising out of the effect or force of this Clause shall be final and binding upon the Contractor.

- **EPF**: The Contractor shall comply with the provisions of EMPLOYEES PROVIDENT FUND SCHEME, 1952; EMPLOYEES' PENSION SCHEME, 1995; AND EMPLOYEES DEPOSIT LINKED INSURANCE SCHEME, 1976; as modified from time to time through enactment of EMPLOYEES PROVIDENT FUND & MISCELLANEOUS PROVISIONS ACT, 1952, wherever applicable and shall also indemnify BHEL from and against any claims under the aforesaid Act and the Rules. The Contractor should allot PF account number and get the nomination form, duly filled in, from each member of workforce deployed by him at the time of joining. Each member of workforce must have his/her Provident Fund KYC completed and his respective UAN must have been allocated. All the Workforce must possess "UAN CARD" having an active UAN (Universal Account Number) so that they can avail all the intended benefits of EPF. The contractor shall deposit Employees and Employer Contributions in the designated accounts with the designated authority for each wage month. After termination of contract or on completion of contract, the contractor shall provide due assistance to their workforce for withdrawal of PF/Pension amount, when due. The Contractor shall liaison with the PF officials to get the annual PF slips and distribute amongst their own workforce.
- **ESI:** The contractor shall strictly comply with the provision of EMPLOYEES' STATE INSURANCE ACT-1948 (to the extent as may be applicable, if any). The Contractor should allot ESI account number and get the nomination form, duly filled in, from each member of workforce deployed by him at the time of joining. At the time of joining, the contractor shall get the self / family registration form filled by each member of workforce and submit to the local ESI office. All eligible Workforce must possess "ESIC SMART PEHCHAN CARD" so that they can avail medical & other intended benefits of ESIC. The contractor shall facilitate collection of issued ESI cards by his workforce.
- As per the PAYMENT OF GRATUITY ACT, 1972, "completion of continuous service of five years is not necessary where the termination of the employment of any employee is due to death or disablement" and hence payment for gratuity in such case during the currency of the contract will be paid to the contractor on submission of copy of proof of disbursement of gratuity payable to his employee. In case of death of the employee of the contractor, gratuity payable to deceased employee shall be paid by the contractor to his nominee or, if no nomination has been made, to his heirs, and where any such nominees or heirs is minor, the share of such minor, shall be deposited with the Controlling Authority. Nomination form as prescribed under Payment of Wages Act must be kept on record and should be considered for extending benefit by the Contractor.
- While engaging & deploying the workforce, Contractor is required to make efforts to provide opportunity for employment to the people belonging to Scheduled Castes and weaker sections of the society also in order to have a fair representation of these sections.
- Online Electronic Cum Challan Receipt (ECR) is available for both EPFO and ESIC independently. Filing & Payment of contribution is also online with no requirement of any

paper document. Establishments can also online file a common Electronic Cum Challan Receipt (ECR) for both EPFO and ESIC on Shram Suvidha Portal.

- The contractor should ensure / check that if your new joining employee (if any) was earlier working & issued with any UAN / ESI Card, if so, insert his details (old) in your portal otherwise register your new workforce immediately. The contractor shall also update mobile/telephone/e-mail/family details/ KYC etc. particulars of all workforce in the EPFO & ESIC portals to enable them to avail all the intended benefits under EPF and ESIC schemes. This will also help statutory authorities in approaching workforce to deliver services/advice quickly.
- The Contractor shall immediately at the time of employment / deployment of any workforce, inform the individual of his rights / benefits (under EPF / ESI etc. schemes) & duties, in writing
- ATTENDANCE RECORD:
- Contractor is required to regulate attendance of the workforce engaged by them. Work/services, duly signed by the Contractor or authorized person on behalf of the Contractor. A physical attendance register (Muster Roll) shall be maintained by the Contractor at work premise for physical verification by BHEL / statutory authorities.
- Contractor to ensure that the employees deployed in the premises of BHEL are physically and mentally fit and do not have any criminal record. Such employees should possess requisite skill, proficiency, qualification, experience etc.
- BHEL shall also arrange necessary gate/ entry pass to Buyer's premise/ designated premise for the manpower. BHEL shall make necessary arrangements for use of basic facilities like water, washrooms etc. for manpower working at BHEL's premise.

13. 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:

- Higher of the minimum wages as declared by the Labour Authority of Centre/State from time to time for the respective category of workmen to be paid. The contractor shall pay to his workmen any increase in the minimum wages as notified from time to time during the period of contract.
- The contractor has to provide free transport facility to his workmen.
- 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.
- EPF shall be paid as per the statutory requirements for all the workers (at present @ 13.15% of the wages by limiting the maximum wages as Rs.15000/-, even for those whose wages is more than Rs. 15000/-). Contractor should mandatorily have EPF registration irrespective of number of workers to be engaged by him. Further, contractor has to ensure PF coverage to all his workers at KKNPP irrespective of their exemption as per rules. He shall ensure

regularly depositing of EPF as per prevailing statutory norms for the workmen deployed for the subject work and proof of deposit shall be produced along with monthly R.A. bills for processing of the next R.A. bill. The contractor shall comply with all the existing/revised provisions of the employee's provident funds and miscellaneous provisions Act, 1952. The contractor should maintain record of statutory EPF amount deposited in the respective EPF accounts of his workers and submit the same with every RA Bill. Contractor is also required to submit EPF returns details of all workers employed in this contract in the prescribed forms 3A, 6A and 12A to the EPF authority with copy to the Engineer.

- 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.

14. SAFETY RULES, DEPLOYMENT OF HSE PERSONNEL & PENALTY

- NPCIL safety rules shall be strictly followed.
- Work permit to be obtained before start of work.
- Safety officer/supervisor shall be deployed after assessment/qualification by NPCIL.
- JHA for the work shall be strictly followed.
- Sketch of the methodology & sequence of handling shall be submitted.
- Qualified supervisor shall oversee the works of lifting, loading, unloading, transportation etc.
- All T&P shall have valid test certificates.
- Ropes/Slings/Belts used in the works shall be free from any defects, of good quality.
- Only Authorised crane operator shall be engaged.
- All PPEs required for the works shall be arranged.
- All persons employed at the construction site should use safety helmets with chin strap, safety shoes & reflective jackets.

- You are requested to strictly abide by the safety requirement prevailing at the site as given in the Tender Specification: **TSS/SCT-063** and as per M/s. NPCIL HSE Rules & regulation.

- **Deployment of Qualified/Assessed HSE Personnel is MANDATORY as per BHEL Instructions.**
- **Up to 100 Workers, 01 HSE Supervisor and 01 HSE Officer must be deployed and rules will be followed as per BHEL Instructions.**

- **PENALTY for Non-Deployment of HSE Officer will be ₹ 75,000.00 Per Man-Month (Rupees Seventy-Five Thousand).**
- **PENALTY for Non-Deployment of HSE Supervisor will be ₹ 50,000.00 Per Man-Month (Rupees Fifty Thousand).**

14.1 SAFETY PROCEDURE FOR SITE WORK

- The Contractor 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.
- The Contractor 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.
- 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.

- 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.
- 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.
- Site-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.
- 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.
- Maximum duty hours of an individual should be as per the Factories Act 1948 or its latest amendment.
- Illumination levels should be as per the statutory requirements.

14.2 Safe Means of Access/Platforms

- Adequate safe means of access and exit should be provided for all work places, at all elevations.
- 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.
- Where the platform for working is more than 3.5 m above ground, the width of the platform should be minimum 1 m.
- 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.
- 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.
- Any working platform on scaffolding or staging more than 3.5 m above the ground or floor should have a guard rail attached, bolted, braced at least 1 m high above the floor or platform of such scaffolding or staging along with mid-rail.
- The planks used for any working platform should not project beyond the end supports to a distance exceeding four times the thickness of the planks used. The planks should be rigidly fixed at both ends to prevent sliding, slipping or tilting. The thickness of the planks should be adequate to take load of men and materials and should not collapse. Plywood or packing wood should not be used as planks.

- The guardrail should extend along the entire exposed length of the scaffolding with only such opening as may be necessary for the delivery of materials. Standard railing should have posts not more than 2 m apart and an intermediate rail halfway between the floor or platform of the scaffolding and the top rail. Such scaffolding or staging should be so fastened as to prevent it from swaying from the building or structure. Scaffolding and ladder should conform to IS 3696 (Part 1): 1987 and (Part II): 1996.
- Working platforms of scaffolds should have toe boards at least 15 cm in height to prevent materials from falling down.
- A sketch of the scaffolding proposed to be used should be prepared and approval by the BHEL Engineer obtained prior to start of erection of scaffolding. All scaffolds should be examined by engineer- in-charge before use.
- Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform or gangway or stairway is more than 3.5 m above ground level or floor level. They should have adequate width for easy movement of persons and materials and should be suitably guarded.
- 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.

14.3 Work at Height

- 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.

- Safety work-permit system for working at height should be obtained from industrial safety section.

- 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.

- Linear movement at height should be reduced to minimum. In case of such movement provision for anchoring the safety belt should be made.

- 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.

14.4 Electrical Safety

- 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.
- The Electricity Act, 2003
- The Indian Electricity Rules 1956 (as amended in 2000)
- The National Electricity Code 2008
- Atomic Energy (Factories) Rules, 1996
- Other relevant rules of statutory bodies and power supply authority
- Relevant standards of BIS

14.5 Material Handling and Lifting Machines and Tackles

- 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.
- The line managers should ensure that the material handling equipment used is adequate to handle the load.
- Manual pulling of heavy equipment and trolley loaded with heavy material is not to be permitted.
- Stacking and handling of heavy materials should be done on a firm ground to prevent settlement.
- 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.
- 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.
- 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).
- 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.

- 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.
- In case of facilities machines, the safe working load should be notified by the engineer-in-charge. As regards the contractor's machines, the contractor should declare the safe working load of the machine to the engineer-in-charge whenever he brings any machinery to site of work and get it verified by the engineer-in-charge, supported by a valid test certificate by the competent person.
- 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.
- No mobile crane should be allowed to move under live high-tension power transmission line.
- While lifting loads, cranes should be located on level ground.
- A thorough load analysis should be carried out before using cranes in tandem.
- 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.
- It should be ensured that the cabin of the lifting machine in outdoor service is made of fire resistant material, has a suitable seat, a footrest and protection from vibration, affords the operator an adequate view of the area of operation, affords the operator adequate protection against the weather, and is provided with fire extinguisher.

14.6 Fire Safety

- 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)].
- 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.
- 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.
- 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.
- Adequate number of trained persons from approved fire training centre required to extend fire safety coverage should be ensured.

- 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.
- Adequate number of trained workmen in firefighting who can operate fire extinguishers should be ensured.
- Portable fire extinguishers with periodic inspection, maintenance and re-filling complying with the mandatory requirements should be ensured.
- Availability of adequate water for firefighting should be ensured.
- 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.

14.7 Housekeeping

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

14.8 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.

14.9 PERSONAL PROTECTIVE EQUIPMENT (PPE)

General

- 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, atomization 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.
- It is thus recognized that use of PPE is an important and necessary consideration in the development of a safety programme. Once the safety professional decides that PPE is to be used by workmen, it is essential to select right type of PPE and management should ensure that workman uses it and also PPE is correctly maintained.
- 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.
- All the PPEs in use should be as per relevant IS standards as referred in the AERB safety guidelines on 'Personal Protective Equipment' (AERB/SG/IS-3).
- 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.
- 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.
- Safety goggles should be of shatterproof type and with zero power.
- All persons working at heights more than 3.5 m above ground or floor and exposed to risk of falling down should use full body harness safety belts, unless otherwise protected by cages, guard railings, etc. In places where the use of safety belts is

not feasible, suitable net of adequate strength fastened to substantial supports should be used.

15. SECURITY RULES & GATE PASS FORMALITIES

- 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, issue of identity cards, control of entry of personnel and all similar matters. The Contractor and his personnel shall abide by all security measures imposed by the Engineer or his duly authorized representative from time to time.

Entry/Exit of Manpower:

- The contract labour shall enter the project premises only through turnstile gate by using the computerized biometric photo entry pass (RFID) issued to them. To ensure traceability/identity, each and every person engaged by the contractor will be required to furnish/upload bio-data of labourers/staff IPMIS (software based tool of NPCIL) 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. The application shall be submitted though IPMIS for Entry/ Exit of Manpower.
- Voter ID/AADHAR Card/Ration Card/Passport/Bank Account Passbook of any Nationalized Bank.
- Based on the submission of the above along with prescribed filled application form for entry permission to site, initially, one-time 3 days (up to 15 days' maximum) temporary pass or permission will be issued to Contractor's personnel for entry to KKNPP-3&4 Project Site areas for training on Industrial Safety / Fire Protection etc. Contractor shall take printout of the passes. The Contractor shall submit the police verification certificate and Medical fitness certificate along with standard application format for issue of Regular pass (RFID). 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. Minors or physically unfit persons shall not be deployed for the work
- All the data so furnished shall be certified by the contractor and countersigned by the Engineer-in-charge (EIC) of work, KKNPP-3&4 along with the undertaking from Contractor personnel that he is not involved in any criminal activity and no FIR or police case is pending against him and further endorsed by the contractor that he stands responsible for the conduct of the worker while working inside the KKNPP-3&4 project areas and countersigned by EIC.
- In the case of loss of entry pass, the contractor concerned shall duly intimate to EIC and Security and should lodge FIR and produce the copy of FIR to security. In this case, also a penalty of Rs. 3000/- shall be deposited by the contractor concerned for issue of fresh entry pass. In case of change of RFID from one contractor to another

contractor, No Objection Certificate from earlier employer shall also to be submitted along with the documents

- On completion of work or return of labourers, the RFID cards shall be returned back to NPCIL. The contractor shall obtain a certificate in this regard from SECURITY and submit it to EIC along with submission of the final bill. 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. Any RFID passes not used for a continuous period of 30 days will be disabled in the system preventing entry of the said person. This can be re-validated only through separate approval. Un-utilised/Expired entry passes shall have to be submitted immediately to NPCIL.
- 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.
- No mobile phone with camera is allowed inside the plant premises
- Mobile phone without camera shall allowed with passes only

16. MATERIAL GATE PASSES

- To bring materials/ equipment/ tools/ tackles etc. inside the plant for construction work, the Contractor has to produce challans/proper documents to security agency engaged by NPCIL at gate. The materials shall be checked thoroughly by security agency engaged by NPCIL at Gate and entry details shall be recorded in their register before allowing any material to bring inside the plant by Contractor. It is Contractor's responsibility to see that the recorded entry number, date, signature of NPCIL's authorized representative with stamp challans/ supporting documents signed by security personnel at gate during entry in the challans also. These challans shall be retained safely and reproduced when material is taken back from KKNPP site. 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 inward/outward of KKNPP-3&4 Project Site areas (in/ out of the main plant boundary), gate pass in standard format shall be used and 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 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 and shifted out of plant premises.

17. VEHICLE PERMIT

- Entry and exit of Contractor's vehicles at KKNPP-3&4 Project site areas for carrying their staff/ labour, and other vehicles like Trucks, Cranes, Trailers, Forklifts, Hydra, JCB, Water Tanker etc shall be controlled through vehicle pass and the application shall be submitted in standard format.
- While entering at the gate, the vehicles shall be checked along with its registration, insurance and driving license of driver.

The following requirements are to be met to obtain vehicle permit:

- Vehicle/P&M etc. should be brought to site in good conditions.
- Valid Road tax certificate, fitness certificate, PUC certificate and insurance policy from competent authority.
- Valid operating/ driving license of driver/operator.
- Vehicle permit shall be applied through IPMIS.

18. MOBILE PASSES

Contractors' staff / labour shall be allowed to carry mobiles without camera / data card /internet facility in to KKNPP-3&4 Project site areas only on approval. They shall submit the application for mobile pass in standard format through IPMIS through ENC.

19. PHOTOGRAPHY IN PROJECT PREMISES

Photography of the Project Premises is strictly Prohibited

20. PENALTY

- Penalty rules of NPCIL-KKNPP will be applicable.
- If any penalty levied by NPCIL/statutory bodies on non-compliance of safety requirements, security requirements and statutory requirement, the same shall be deducted from the bill.

21. REJECTION OF THE BIDS:

a. If a bidder quotes 'NIL/ZERO' service charge, the bid shall be treated as unresponsive/Null

& Void and will not be considered for evaluation (in terms of provisions of Ministry of Finance, Dept. of Expenditure No. 29(1)/2014-PPD dated 29.01.2014).

b. BHEL reserves the right to accept or reject any of the bid / all bids with or without deviation
or cancel / withdraw the invitation for bid without assigning any reason whatsoever and in such case, bidder shall have no claim arising out of such action by BHEL. The acceptance of bid will rest with BHEL, not binding itself to accept the lowest tender.

c. BHEL also reserves the right to cancel the tender at any stage due to any administrative / internal reasons; whatsoever and in such case bidder(s)/successful bidder shall have no claim arising out of such action by BHEL.

d. Unsolicited bids, bids which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc., are liable to be rejected.

e. If a bidder who is a proprietor expires after the submission of his bid or after the acceptance of his bid, BHEL may at their discretion, cancel such a bid. If a partner of a firm expires after the submission of tender or after the acceptance of the tender, BHEL may then cancel such tender at their discretion, unless the firm retains its character.

f. If the bidder deliberately gives wrong information in his bid, BHEL reserves the right to reject such bid at any stage or to cancel the contract if awarded and forfeit the Earnest Money/Security Deposit/any other money due.

g. Canvassing in any form in connection with the bids submitted by the Bidder shall make his offer liable to rejection.

h. In case the Proprietor, Partner or Director of the Company/Firm submitting the tender, has any relative or relation employed in BHEL, the authority inviting the tender shall be informed of the fact along with the Offer. Failing to do so, BHEL may, at its sole discretion, reject the tender or cancel the contract and forfeit the Earnest Money / Security Deposit.

i. "The offers of the bidders who are under suspension and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL website www.bhel.com.

Integrity commitment, performance of the contract and punitive action thereof:

22. RISK AND COST FOR THE WORKS

A) In the event of failure of the contractor to bring necessary T&Ps 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.

B) In the event of non-mobilization of 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.

C) 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.

D) 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.

23. BREACH OF CONTRACT, REMEDIES AND TERMINATION

"As per SS&P Circular No 12 of 2023-24 Date 29.09.2023/Amendment No-07 of the Works Policy-2016"

In case of breach of contract, wherever the value of security instruments like Performance Bank Guarantee available with BHEL against the said contract is at least 10% of the Contract Value, the same be encashed. In case the value of the security instruments available is less than 10% of the contract value, the balance amount be recovered from other financial remedies (i.e. available bill of the contractor, retention amount, etc with BHEL) or legal remedies be pursued. The balance scope shall be got done independently without Risk and Cost of the failed supplier/contractor.

Further, levy of liquidated damages, debarment, termination, de-scoping, short-closure, etc, shall be applied as per provisions of the contract.

24. LIQUIDATED DAMAGES (LD) / PENALTY

If the contractor fails to maintain the required progress of work which results in delay in the completion of the work as per the contractual completion period, BHEL shall have the right to impose **Liquidated Damage/Penalty at the rate of 0. 5% of the contract value**, per week of delay or part thereof subject to a **maximum of 10% of the contract value.** For this purpose, the period of delay shall be the **delay attributable to the Contractor** for the completion of work as per the contract. Contract Value for this purpose shall be the final executed value exclusive of ORC, Extra Works executed on Man-day rate basis, Supplementary / Additional Items, and PVC.

25. TREATMENT OF CASES REGARDING CONFLICT OF INTEREST: *(Aa:Ssp:CoI Date-05.06.2025, Circular 3 Of 2025-26)*

The bidder notes that a conflict of interest would said to have occurred in the tender process and execution of the resultant contract, in case of any of the following situations:
i) If its personnel have a close personal, financial, or business relationship with any personnel of BHEL who are directly or indirectly related to the procurement or execution process of the contract, which can affect the decision of BHEL directly or indirectly;

ii) The bidder (or his allied firm) provided services for the need assessment/ procurement planning of the Tender process in which it is participating;

iii) Procurement of goods directly from the manufacturers/suppliers shall be preferred. However, if the OEM/Principal insists on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer/ supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer/ supplier could bid directly but not both. In case bids are received from both the manufacturer/ supplier and the agent, bid received from the agent shall be ignored. However, this shall not debar more than one Authorised distributor (with/ or without the OEM). from quoting equipment manufactured by an Original Equipment Manufacturer (OEM) in procurements under a Proprietary Article Certificate.

iv) A bidder participates in more than one bid in this tender process. Participation in any capacity by a Bidder (including the participation of a Bidder as a partner/ JV member or sub-contractor in another bid or vice-versa) in more than one bid shall result in the disqualification of all bids in which he is a party. However, this does not limit the participation of an entity as a sub-contractor in more than one bid if he is not bidding independently in his own name or as a member of a JV.

The Bidder declares that they have read and understood the above aspects, and the bidder confirms that such conflict of interest does not exist and undertakes that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder{s), in this regard. This applies in particular to prices, specifications, certifications, Subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
In case, the Bidder is found having indulged in above activities, the same will be considered as a violation of the tender conditions, and suitab1e action shall be taken by BHEL as per extant policies/ guidelines.

26. GRIEVANCE REDRESSAL MECHANISM

- To promote transparency and ensure fair treatment of all bidders, a structured Grievance Redressal Mechanism is in place to address any concerns or issues arising during the tendering process or in subsequent business dealings with the company.

- Suppliers/Contractors are requested to follow the below escalation process for grievance resolution:

- **First Level**: Any grievance should initially be addressed to the designated Dealing Officer, GM & Project Director / BHEL KKNPP Site.

- **Second Level**: If the issue remains unresolved, it may be escalated by lodging a formal grievance through the SUVIDHA Portal: https://suvidha.bhel.in/suvidha/. Responses will be provided in accordance with the defined escalation matrix."

27. SUVIDHA PORTAL APLLICATION / INVOICING

- **For goods / works / services on Indian Suppliers / Contractors:**
- Irrespective of the value of the invoice amount, the supplier/ contractor should necessarily upload the invoice details on BHEL SUVIDHA portal at https://suvidha.bhel.in/suvidha/, prior to despatch/raising invoice. All documents as per contract checklist, along with additional documents (if any), must be uploaded on the portal.
- It is mandatory that tax invoices with a net amount (including taxes) exceeding **Rs. Five Lakhs** uploaded on the portal are digitally signed using a **Class 3 Digital Signature Certificate (DSC)** issued by a licensed Certifying Authority. Submission of invoice document in hard copy is allowed for invoices with a net amount (including taxes) equal to and up to **Rs. Five Lakhs** in case the requirement for digitally signed invoice is not explicitly mentioned in the contract checklist.
- **The Invoice will not be accepted in absence of the above.**

28. SPLITTING OF THE WORKS

- As per enclosed Annexure and splitting Ratio will be 60:40.

29. CONTRACTOR'S OBLIGATION ON COMPLETION

On completion of work, all the temporary buildings/construction, structures, facilities etc. shall be dismantled and levelled and debris shall be removed as per instruction of BHEL by the contractor at their cost. All statutory formalities to be completed. RFID/gate passes shall be returned. 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.

30. LIST OF ANNEXURES:

a. Annexure 1 – Schedule of Quantities (SOQ)
b. Annexure 2 – Stage Payment
c. Annexure 3 – Work procedure for CS/During Site Visit by Bidder
d. Annexure 4 – Work procedure for SS piping/During Site Visit by Bidder
e. Annexure 5 – Quality Plan for CS piping/During Site Visit by Bidder
f. Annexure 6 – Quality Plan for SS piping/During Site Visit by Bidder
g. Annexure 7 - WAM22/F-22 format /Consortium Agreement
h. Annexure 8 – Splitting of the Works
i. Declarations
j. PQR
k. Part- I Chapter- VIII – Taxes & Duties
l. Part- II Chapter- X – General Conditions
m. Part- II Hire Charges

n. Part- II Chapter- I GCC SCC Corrections
o. Part- II HSE14 Rev02 Manual
p. Part- III Reverse Auction Guidelines
q. Integrity Pact (IP)
r. **Other Drawings and Documents will be issued during Site visit/At the time of Contract Awarding.**

REMARKS: - Latest Corrigendum, Latest Amendment /email Clarification will be applicable from time to time and will be binding to Bidders.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)
Kudankulam Nuclear Power Project – Unit 3&4
Kudankulam Post, Radhapuram Taluk, Tirunelveli Dist,
Tamil Nadu- 627 106

Sl. No.	PRE-QUALIFICATION CRITERIA (PQR)
B	**TECHNICAL**
B.1	Bidder should have executed Similar works for any one of the following in the **Last Seven Years** from latest date of bid submission: - One (1) Work of value not less than **₹ 80.00 Lakhs (Rupees Eighty Lakh).** OR Two (2) Works each of value not less than **₹ 40.00 Lakhs (Rupees Forty Lakh).**
B.2.	**EXECUTED** 1)"Piping/Supports/Structural works executed for any PSUs/ major private companies/Worked under reputed companies." (AND) 2)"All the bidders are advised to visit (or bidders authorized representative) the site and work location before submission of bid to avoid any ambiguity in the scope of works."
C: C-1	**FINANCIAL** **Turnover** Bidders must have achieved an average Annual Financial Turnover (Audited) of **₹ 80,00,000.00 (Rupees Eighty Lakh)/-** or more over in the last **Three Financial Years** (FYs), i.e., FY 2022-2023, 2023-2024 & 2024-2025.
C-2	**Net Worth** (Only in case of companies) of the bidder should be positive. Note: Net worth shall be calculated based on the latest Audited Accounts as furnished for 'C-1' above. Note: Net worth = Paid up share capital + Reserves
C-3	**PROFIT** Bidder must have earned **PROFIT** in any one of the **Five Financial Years** as applicable in the Last Five Financial Years preceding the present (i.e FY 2020-2021, 2021-2022, 2022-2023, 2023-2024 & 2024-2025 as on date) Bidders to submit audited Balance Sheet and Profit & Loss Statement for the year as supporting documents. Note: PROFIT shall be PBT earned during any one year of Last Five financial years.
C-4	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under Liquidation / BIFR, which will render him ineligible for participation in this tender, and shall submit undertaking to this effect. (As per Format provided at Annexure to this NIT).

Explanatory Notes for the PQR (unless otherwise specified in the PQR):

1. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against C-1 above along with all annexures.
2. In case audited financial statements have not been submitted for all the three years as indicated against C-1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e. total divided by three.
3. If Financial Statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by Chartered Accountant.
4. C-2: -NETWORTH: Shall be calculated based on the latest Audited Accounts as furnished for 'C-1' above. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated only in case of companies)
5. C-3: - PROFIT shall be PBT earned during any one year of last Three financial years.

BHARAT HEAVY ELECTRICALS LIMITED/BHEL-PSSR Kudankulam, 2x1000 Mwe							
NIT REFERENCE: BHEL:PSSR:KKNPP:TSS:SCT-063							
SECONDARY CYCLE PIPING							
Work-Erection of Small bore piping and supports							
PRICE BID							
SOQR NO.	**DESCRIPTION**	**UOM**	**QTY**			**Weightage (7 digits)**	**Lump-Sum Cost INR**
F2	**Welding of small bore CS piping**	**Inch Dia**	4872.75			0.2480021	
F4	**Welding of SS pipe, Type-Butt Weld**	**Inch Dia**	1624.25			0.0869066	
F8	**Erection of CS, SS piping systems**	**Inch Mtr**	7030.00			0.0899080	
F11	**Cold bending of pipes**	**Nos**	1610.00			0.0203106	
F13	**Valve Testing**	**MT**	1.12			0.0009770	
F14	**Erection of valves**	**MT**	1.12			0.0012897	
F15	**Fabrication and erection of supports**	**MT**	15.3382			0.1705727	
F19	**Weld Joint Inspection by RT (Gamma Ray)**	**Inch Dia**	942.00			0.0254062	
F21	**Weld Joint Inspection by UT (Ultrasonic Test)**	**Inch Dia**	0.00			0.0000000	
F23	**Hydro/Pneumatic test of Piping System**	**Inch Mtr**	7030.00			0.0281349	
F24	**Preparation of isometric drawings for piping systems, its submission and approval:**	**RM**	10545.00			0.1584469	
H9	**Removal of erected material**	**MT**	10.00			0.0142745	
L8.5.1	**Erection and dismantling of Scaffolding**	**CUM**	1500.00			0.0394427	
L8.5.2	**Hire charge for scaffolding**	**CUM-day**	4000			0.0130259	
L9.3	**Insitu Modification works:** Longitudinal seam Welding (Butt/groove) of carbon steel, low alloy steel, stainless steel components using SMAW process:	**CUM-CM**	5000			0.1033023	
						1.0000000	

Notes:-

1. Price should be quoted in Lump-Sum.
2. Price should be excluding GST.
3. Package-A will be awarded 60% only
4. Package-B will be awarded 40% at L1 price

BIDDER SIGNATURE WITH STAMP

BHARAT HEAVY ELECTRICALS LIMITED/BHEL-PSSR Kudankulam, 2x1000 Mwe					
NIT REFERENCE: BHEL:PSSR:KKNPP:TSS:SCT-063					
SECONDARY CYCLE PIPING					
Work-Erection of Small bore piping and supports					
SCHEDULE OF QUANTITIES (SOQ)					
SOQR NO.	**DESCRIPTION**	**UOM**	**QTY**	**Pkg A**	**Pkg B**
F2	**Welding of small bore CS piping**	**Inch Dia**	4872.75	2923.65	1949.1
F4	**Welding of SS pipe, Type-Butt Weld**	**Inch Dia**	1624.25	974.55	649.7
F8	**Erection of CS, SS piping systems**	**Inch Mtr**	7030.00	4218	2812
F11	**Cold bending of pipes**	**Nos**	1610.00	966	644
F13	**Valve Testing**	**MT**	1.12	0.6738	0.4492
F14	**Erection of valves**	**MT**	1.12	0.6738	0.4492
F15	**Fabrication and erection of supports**	**MT**	15.3382	9.20292	6.13528
F19	**Weld Joint Inspection by RT (Gamma Ray)**	**Inch Dia**	942.00	565.2	376.8
F21	**Weld Joint Inspection by UT (Ultrasonic Test)**	**Inch Dia**	0.00	0	0
F23	**Hydro/Pneumatic test of Piping System**	**Inch Mtr**	7030.00	4218	2812
F24	**Preparation of isometric drawings for piping systems, its submission and approval:**	**RM**	10545.00	6327	4218
H9	**Removal of erected material**	**MT**	10.00	6	4
L8.5.1	**Erection and dismantling of Scaffolding**	**CUM**	1500.00	900	600
L8.5.2	**Hire charge for scaffolding**	**CUM-day**	4000	2400	1600
L9.3	**Insitu Modification works:** Longitudinal seam Welding (Butt/groove) of carbon steel, low alloy steel, stainless steel components using SMAW process:	**CUM-CM**	5000	3000	2000

SECONDARY CYCLE PIPING

TENDER. NO. : BHEL/PSSR/KKNPP-3 & 4/TSS/SCT-063

STAGE PAYMENT

SOQ Item No	Stage Payment No.	Description of Stage Payments	% Alloted
Welding of CS,SS pipe, Type-Butt/Fillet Weld			
F2	1	Submission of WIR	95
F2	2	Material Accounting & Demobilsation	5
Welding of SS pipe, Type-Butt Weld			
F4	1	Submission of WIR	95
F4	2	Material Accounting & Demobilsation	5
Erection of CS/ SS piping systems			
F8	1	Submission of Erection report	95
F8	2	Material Accounting & Demobilsation	5
Cold bending of piping			
F11	1	Bending Inspection Report & NDT Report	95
F11	2	Material Accounting & Demobilsation	5
Valve Testing (CS/SS/Ti):			
F13	1	Submission of Valve testing report	95
F13	2	Material Accounting & Demobilsation	5
Erection of Valves (CS/SS/Ti)			
F14	1	Submission of Valve erection report	95
F14	2	Material Accounting & Demobilsation	5
Fabrication and erection of supports			
F15	1	Submission of support erection report	95
F15	2	Material Accounting & Demobilsation	5
Weld Joint Inspection by RT (Gamma Ray)			
F19	1	Submission of RT report & WIR	95
F19	2	Material Accounting & Demobilsation	5
Weld Joint Inspection by UT (Ultrasonic Test):			
F21	1	Submission of UT report & WIR	95
F21	2	Material Accounting & Demobilsation	5
Hydro/Pneumatic test of Piping System			
F23	1	Submission of CRR (Circuit Release Report)	50
F23	2	Submission of Hydrotest Report	45
F23	3	Material Accounting & Demobilsation	5
Preparation of isometric drawings for piping systems, its submission and approval:			
F24	1	Verification of drawing & Approval by NPCIL	100
Removal of erected material			
H9	1	Removal Report	95
H9	2	Material Accounting & Demobilsation	5
Erection and dismantling of Scaffolding			
L8.5.1	1	Erection Report	50
L8.5.1	2	Dismantling Report	50
Hire Charges for scaffolding			
L8.5.2	1	Clearance Report	100
Insitu Modification works:			
L9.3	1	Clearance Report	100

BHARAT HEAVY ELECTRICALS LIMITED
(भारत हेवी इलेक्ट्रिकल्स लिमिटेड)
KUDANKULAM NUCLEAR POWER PROJECT UNIT-3&4

TENDER. NO.: BHEL/PSSR/KKNPP-3 & 4/TSS/SCT-063

SPLITTING OF THE WORKS

The entire scope of work (As per SOQ & UOM) is being split into two packages **(Package-A and Package-B**) in ratio 60:40 and will be awarded to two bidders.

• BOQ/Rate Schedule enclosed is applicable for the total quantity of Package-A and Package-B.

• The successful bidder against this tender will be awarded the contract for Package-A (60%: of the SOQ & UOM).

• BHEL may award the contract for second package (40%: As per SOQ & UOM) on the same terms and conditions of tender to the next lowest bidder in the order of competitiveness (i.e., L2, L3 and so on till H1 in that order) if they match their total amount quoted with the total amount as accepted by M/s. BHEL for L1 bidder.

However, BHEL reserves the right **to not award Package-B** in this manner at its sole discretion, without furnishing any reason to the bidders.

• Thus, the work for the two packages will be awarded to two agencies.

• In case BHEL opts to go for re-tendering for award of work for the second package, then the successful bidder who is awarded with first package work shall not be considered for the second package work.

• Each package will be treated as a separate contract.

BHEL's decision in tender evaluation shall be final and binding.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)
Kudankulam Nuclear Power Project – Unit 3&4
Kudankulam Post, Radhapuram Taluk, Tirunelveli Dist,
Tamil Nadu- 627106

BHEL: PSSR: KKNPP: TSS: F-1002: TO-987 Date: 16-12-2022

To

Shri. LENIN MATHEW/SO-F,
Engineer In-charge,
TG-Package-NPCIL-KKNPP Unit3&4,
Kudankulam Post, Radhapuram Taluk,
Tirunelveli Dist-Tamil Nadu-627106

Subject: Submission of the revised work procedure – CS piping, I46/KK34/0/0/CC/WPR/WD018 – R01 Kudankulam NPP Unit-3&4 reg.

Ref: WO:400442

Dear Sir,

We are herewith submitting the revised work procedure for Erection , Alignment and Welding of CS pipes in Secondary Cycle piping.

Document No.: **I46/KK34/0/0/CC/WPR/WD018-R01**

Thanking You

For and on behalf of
BHARAT HEAVY ELECTRICALS LTD

Sanjiba Nanda Naik/Sr.DGM/BHEL
Site Incharge/TSS Package

KKNPP-3&4

FE review comments

1) Since clause-13.7 is revised the same may be indicated in revision status sheet.

2) Old comments along with the corrective action taken for resolving the comments may be submitted along with the procedure for faster clearance at our end.

P. Ramendra, 28.12.22
SO/E, FE.

→ Shri Lenin Mathew
SO/F (Mechanical-384)

The Claus 13.7 is Corrected as per Ro version. The revision Sheet is revised. FE may Concur the Same.

29/12/2022
(Uma Shankar)
SO/E

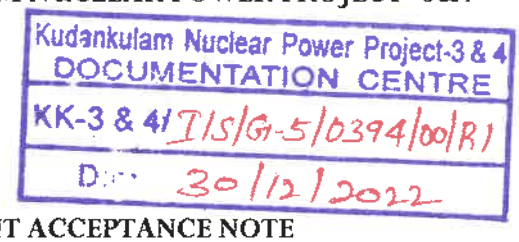
~~29-12-22~~
→ Shri Rajendra Patnaik

→ ~~FE~~

→ Uma Shankar Patnaik
SO/E (Mechanical-384)

क्षेत्र अभियांत्रिकी. ब्लॉक-384
जावक सं Outward No. 2194
दिनांक Date 29/12/2022
FIELD ENGINEERING, KK-384

न्यूक्लियरपॉवरकॉर्पोरेशनऑफइंडियालिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
(भारतसरकारकाउद्यमA Govt. of India Enterprise)
कुडनकुलमन्यूक्लियरपॉवरप्रोजेक्टKUDANKULAM NUCLEAR POWER PROJECT- 3&4



दस्तावेजस्वीकृतिसूचना DOCUMENT ACCEPTANCE NOTE

Document No	I46	KK34	0	0	CC	WPR	WD-018-r01

दस्तावेजशीर्षक Document Title	Work Procedure for Erection , Alignment, Welding of CS pipes, valves in Secondary cycle piping in UMA,UMV building - Unit-3 & 4.
संविदाकार Contractor	M/s BHARAT HEAVY ELECTRICALS LIMITED
कार्यआदेशसं. Work Order No.	400442 dated 05.08.2019
कार्यकानाम Name of Work	Erection work of Turbine, Generator, Condenser, Secondary cycle & Sea Water System Equipment's and piping including Painting, Insulation, Anti Corrosive Coating and structural steel works in turbine building and sea water structure of KKNPP 3&4

उपर्युक्तदस्तावेजकीसमीक्षाकीगईहैऔरलागूडब्लूडी,
कोडऔरविनिर्देशोंकीआवश्यकताओंकीपुष्टिपाईगईहै।
Above document has been reviewed and found conforming to the requirements of applicable WDs, codes and specifications.

गतिविधिActivity	अनुभागSection	नामएवंपदनाम Name & Designation	हस्ताक्षरएवंदिनांक Signature & Date
समीक्षित Reviewed by	Mechanical	SUNIL KUMAR SABAT, SO-E	20/12/2022
		Uma Shankar Patnaik, SO/E	20/12/2022
		Lenin Nath SO/E	21/12/22
सहमत Concurred by	QA	S V Ulvekar SO/E	27/12/2022
		Recommended K A Rawal Head QA	27/12/2022
	FE	Ravindra Pawashe SO/E	P. Narendra 29/12/22
स्वीकृत Accepted by	Mechanical	G. SOMASEKHAR ACE(Mech-TG)	30/12/2022

Controlled Copy Distribution List

Sl.No.	Controlled Copy No.	ISSUED TO		
		Department	Responsible Person	Type of Control
NPCIL				
01	01	NPCIL MECH	ENC/TSS PACKAGE	CONTROL COPY
02	02		MECHANICAL-GROUP HEAD	CONTROL COPY
03	03	NPCIL QA	HEAD - QA	CONTROL COPY
04	04	NPCIL FE	HEAD - FE	CONTROL COPY
BHEL				
05	05	BHEL	SITE INCHARGE	CONTROL COPY
06	06	BHEL -ERECTION	MECHANICAL - HEAD	CONTROL COPY
07	07	BHEL DOCUMENTATION	DOCUMENT CONTROLLER	MASTER COPY

	Prepared by	Reviewed by	Reviewed by	Approved by	Issued by
Name	Kartik P	Muhammed Quraish A.V.M	Shashi Kant Saini	Sanjiba Nanda Naik	R. Thanasekaran
Designation	Dy.Manager	Manager - SCP	Manager – Quality	Site Incharge	Document Controller
Signature					
Date	16.12.2022	16.12.2022	16.12.2022	16.12.2022	16.12.2022

Revision Status

Rev.No.	Date of 1st Issue/Rev.	Description
00	16.11.2021	Work Procedure for Erection , Alignment , and Welding of CS pipes of Secondary Cycle piping and Sea water system piping -Unit-3 & 4.
00	04.12.2021	NPCIL /Mech and NPCIL /QA comments incorporated.
.00	22.02.2022	NPCIL/QA and NPCIL/FE comments incorporated.
00	24.03.2022	NPCIL/QA comments incorporated.
01	16.12.2022	Annexure A revised. Annexure B to E removed

	Prepared by	Reviewed by	Reviewed by	Approved by	Issued by
Name	Kartik P	Muhammed Quraish A.V.M	Shashi Kant Saini	Sanjiba Nanda Naik	R. Thanasekaran
Designation	Dy.Manager	Manager - SCP	Manager – Quality	Site Incharge	Document Controller
Signature					
Date	16.12.2022	16.12.2022	16.12.2022	16.12.2022	16.12.2022

CONTENTS

1.0 SCOPE:

Receipt of piping components from NPCIL Store, transportation, pre-fabrication, erection, alignment, welding, completion of permanent supports, non-destructive examination of welded joints, hydraulic testing of pipelines, preservation of piping, valves and excluding the installation of throttling and flow orifices in turbine building of NPCIL KNPP-Unit 3&4. Applicable systems are enclosed in Annexure A. SS piping of PGB84.WD001, torque tightening of flanges, supports are also excluded from the scope of this procedure.

2.0 PURPOSE:

The purpose of this procedure is to elaborate step by step method to be adopted for performing piping erection activities in a systematic way.

3.0 APPLICABILITY:

This procedure is applicable for all WDs of CS piping mentioned in Annexure A

4.0 RESPONSIBILITY:

The responsibility for implementation of this procedure lies with BHEL/PSSR site in charge-Kudankulam.

Sl no	Description	Responsible person
1	Materials receipt	BHEL-Erection HOS
2	Piping Fit-up, Erection and Welding	BHEL-Erection HOS
3	Co-ordination with NPCIL for QP control point clearance, Inspection & Testing	BHEL-QC HOS

5.0 REFERENCE DOCUMENTS:

Sl No.	Doc. No	Description
1	Tender document: No. NPCIL/KK/-3&4/CONST/MECH/PT/2018/56	Technical specification –Section V
2	SNIP 3.05.05-84	Construction Norms and Rules. Technological equipment and Technological Pipelines.
3	RD-153-34.1-003-01	Welding thermal treatment and control of tube systems of boilers and pipelines during assembly and repair of power engineering equipment.
4	SN-527-80	Introduction of Designing of Technological Steel Pipe-Lines with Pnom upto 10 Mpa
5	I02.KK34.0.0.TH.TS.PR009 R01	Technical Specification for painting of sea water system, equipment, piping & structures
6	I02.KK34.0.0.TH.TS.PR017 R01	Technical Specification for painting of structure system and components of free access area (non-radioactive)
7	I46.KK34.0.0.QA.QFS.WD 003	Work procedure for Dye penetrant testing
8	I46.KK34.0.0.QA.QFS.WD 004	Work procedure for Visual and measuring examination testing
9	I46.KK34.0.0.QA.QFS.WD 006	Work procedure for De-preservation and Re-preservation
10	I46.KK34.0.0.QA.WPR.WD 001	Work procedure for Technology certification of welding procedure specification
11	I46.KK34.0.0.QA.QFS.WD 001	Work procedure for certification of welder performance Qualification
12	I46.KK34.0.0.CC.WPR.WD 004	Work Procedure for Application of Anti-Corrosive Coating (Polyester Glass Flake) for internal Surface & External surface of sea water pipes
13	I46.KK34.0.0.CC.WPR.WD 014	Work Procedure for Application of Anti-Corrosive Coating (Polyester Glass Flake) for internal Surface of sea water pipes by pipe sprayer method
14	I46.KK34.0.0.QA-QFS-WD029	Work procedure for Hydro testing of pipe lines
15	I46.KK34.0.0.QA.QP-WD026	Quality plan for Erection and Alignment of Piping of Carbon Steel Piping
16	I46.KK34.0.0.CC.WPR.WD 009	Work procedure for mounting of o-lets and thermo well lugs

17	I46.KK34.0.0.CC.WPR.WD005	Work procedure for Foreign Material Exclusion
18	I46.KK34.0.0.QA.QFS.WD005	Work Procedure for Incoming Material Inspection Report
19	I46.KK34.0.0.CC.WPR.WD020	Work Procedure for Grit blasting and painting for CS pipes in secondary cycle piping and its support
20	I46.KK34.0.0.CC.WPR.WD-021	Work Procedure for Weld / Mechanical Joint Identification and Marking for Equipment and Pipelines
21	I46.KK34.0.0.QA.QFS.WD-031	Work Procedure for Valve testing
22	PNAEG7-003-87	Certification rules for welders of nuclear power plant, equipment and pipe lines
23	PNAEG 7-010-89	Welding joint & Weld surface Inspection Regulations
24	GOST 18442-80	Non-Destructive Testing
25	PNAEG 7-009-89	Welding & Weld surfacing of equipment and applications
26	PNAEG 7-008-89	Regulations for design and safe operation of equipment and pipe lines of Nuclear facilities
27	RD 34-10.030-89	Rules for checking quality of welded joints of Nuclear Power Plant pipelines
28	OST 34-42-659-84	Butt welded joints
29	OST 34-42-670-84	Connecting branches/fillet welded joint

6.0 EQUIPMENT, TOOLS& TACKLES:

The following tools will be used for assembly, erection, alignment & Inspection purposes

6.1 Machineries, Tools and tackles:

a) Hydraulic jacks (5 Ton/2 Ton) – 1no.
b) Tyre Mounted Movable Trolley – 1no.
c) Dumpy level – 1no.
d) Hammer (5lbs.& 10 lbs.) – 1no.
e) PP Belt – 1no.
f) Web sling/wire rope slings – 6nos.
g) Welding Generator /Tyristor controlled rectifiers , 400A – 6nos.
h) TIG welding torch – 4nos.
i) Welding consumables like argon gas, electrodes for temporary welds (E6013, E7018).
j) Gas cutting set – 1no.
k) Acetylene cylinders/LPG cylinders and Oxygen Cylinders – 2set.

l) Master electrode baking oven 500°C – 1nos.
m) Portable electrode holding oven 150°C – 6nos.
n) Hydra 14-20MT, trailer – 20ft/40ft
o) Cutting machine – 2nos, Grinding machine, AG4-3nos, AG7-2nos..
p) Ladder-1no., Torch light-2nos.
q) Chain Pulley block, 2T/3T – 4nos, 5T – 3nos.
r) Spanner set – 1no
s) Skid roller – 1set
t) Manual torque wrench, ratchet type – 1no.

6.2 Measuring devices:

a) Water level.
b) Sprit level.
c) Plumb bob.
d) Steel Rule (1ft., &2ft.)
e) Measuring tapes (3,5,15 metres)
f) Steel tape 50 M ,15 M,5 M.
g) Plumb bob
h) Weld gauge, Try square, Vernier caliper, feeler gauge.

7.0 PRE-REQUISITES:

a) Availability of NPCIL clearance for erection of pipelines.
b) Availability of erection scheme and schedule.
c) Availability of required working drawings, DCNs, TARs for erection.
d) Availability of material.
e) Availability of pipe pedestals, EPs, structural members for erection of supports
f) Availability of all tools and tackles with valid test certificates
g) Availability of valid calibration certificates for all measuring instruments.
h) Availability of handing over protocol for pipe pedestals from NPCIL,civil for co-ordinate and level of EPs
i) Availability of control point co-ordinates
j) Ensuring that blocks are supplied as pér WD requirement.
k) Availability of PPEs for workmen and staffs.
l) Availability of approved JHA.
m) Availability of approved Construction Safety Work Permit
n) Compliance of JHA and daily work permit for the work.
o) Availability of approved work procedure & QP
p) Availability of approved WPS
q) Availability of qualified welders
r) Availability of fitters, riggers, helpers, grinders
s) Availability of wooden sleepers, temporary structural materials

t) Briefing of job to workmen before start of work on daily basis
u) Ensure good housekeeping
v) Availability of power supply
w) Availability of temporary storage area for T&Ps, welding machines, scraps.

8.0 SEQUENCE OF ACTIVITIES:

a) Preparation of Work procedure.
b) Preparation of QP.
c) Welding procedure qualification.
d) Welder qualification.
e) Issue of materials and preparation of IMIR.
f) Qualification of grit blaster and painter
g) Grit blasting and Painting.
h) Shifting of materials to erection area
i) Testing of valves
j) Cleaning of pipelines.
k) Joint codification
l) Pre assembly of piping.
m) Marking of pipeline axes
n) Positioning of piping
o) Fit up
p) Welding.
q) NDT.
r) Erection of permanent supports.
s) Locking of spring supports before hydraulic testing.
t) FME inspection.
u) Hydraulic testing.
v) Flushing of pipe lines.
w) Floating of pipe lines.
x) Re-preservation.
y) CRR.

9.0 MATERIAL CONTROL AND INCOMING MATERIAL INSPECTION

a) Material requisition form has to be filled with details of package numbers, SSIR, quantities.
b) Raise CIV based on material requisition form and material to be received from storage area/shed of NPCIL

c) Material on receipt from NPCIL shall be checked to meet incoming inspection requirement as per approved procedure I46-KK34-0-0-QA-QFS-WD005.

d) The following checks are to carried out before taking the materials for erection and report to M/s NPCIL for any deviation
   i) KKS, block nos, line numbers on the pipes and fittings
   ii) Tag numbers of valves
   iii) diameter and length of pipes
   iv) Availability of attachments like nozzle, support plates as per drawing

e) Check for completeness of shipment with reference to item details of supports, block details of piping with reference to the WDs and SSIR details. Deficiency, if any shall be brought to the notice of ENC/NPCIL.

f) Material shall be kept over wooden sleepers/concrete sleepers/structural members.

g) Precaution to be taken to avoid entry of water, foreign materials inside pipes and fittings

h) Precaution to be taken while storing SS materials. SS material shall not be kept near CS materials. Sufficient distance shall be maintained to ensure that SS materials do not touch the CS materials. SS pipes shall not be kept near the vicinity of CS pipe grinding also.

i) System pipelines along with their respective supports shall be received from NPCIL stores (Support material will be supplied in loose condition such as body of support, support clamp, clamp fasteners, shim plates, guide plates, hanger rods, spring assembly, supporting structure).

j) All the received components shall be segregated support wise and identification marking shall be made by tagging. Once identified and marked, care shall be taken not to interchange the items.

k) While taking motorized valves from NPCIL stores, ensure that the power supply units /connection sockets coming along with valves are not drawn from stores.

l) If any power supply units are coming along with actuator, the same has to be handed over to NPCIL writing KKS code of the element.

m) Ensure preservation and proper storage of issued material at BHEL stores as per procedure I46-KK34-0-0-QA-QFS-WD006.

10.0 COATING/PAINTING

a) Anti-corrosive Coating of Internal surface of Pipeline:

Internal Coating of pipes, fittings of PAB, PAB90,PAS systems are to be carried out with Anti – Corrosive Coating (Polyester Glass Flake) at BHEL coating shed/site as per the approved coating procedure I46/KK34/0/0/CC/WPR/WD004, I46/KK34/0/0/CC/WPR/WD014. Pre fabrication like flange welding, attachment welding for supports shall be completed before inside coating. Assembly of piping shall be carried out either at erection location in UMA building or at BHEL fabrication area.

b) Coating of External Surface of Pipeline and Support:

The external surface of CS pipes supports and structures will be painted as per approved painting procedure I46/KK34/0/0/CC/WPR/WD020.

c) The grit blasting and painting shall be carried out before erection.

11.0 SHIFTING OF MATERIAL TO SITE:

a. After fabrication and painting work – external, internal painting (if applicable) the piping components are to be shifted to site.
b. Pipes are to be identified based on clause 9.0 d).
c. The materials must be properly packed and lashed before transportation.
d. Packing and wedges shall be provided to prevent slipping of materials.
e. Precautions shall be taken to avoid falling or rolling or slipping of materials.
f. Material shall be kept as per clause 9.0 f), g), h)
g. After stacking of pipe spools, all assembled spools shall be covered by Tarpaulin sheet.
h. Pipes should be kept in an orderly manner, so that they do not roll down or slide during handling.
i. Pipe spools shall be handled using cranes
j. Approved JHA to be followed during shifting.

12.0 CLEANING OF PIPELINES

a) The pipeline, valves should be cleaned manually or with compressed air before erection so that foreign particles are removed.
b) Approved work procedure for FME-BHEL-KKNPP3&4/TSS/WP/014 (I46-KK34-0-0/CC/WPR/WD005) shall be followed.

13.0 ERECTION OF PIPING:

13.1 PIPING PRE ASSEMBLY:

a) To reduce the quantum of work at higher elevations, pre-assembly may be done at floor level before erection to final location of pipes/fittings.
b) Line numbers and block numbers to be checked with reference to the applicable WDs
c) Dimensions – length of individual blocks and the total length after assembly shall be checked.
d) Orientation of nozzles (if applicable) – orientation (degree/inclination) shall be such that after erection to final positions , degree/inclination shall be in line with that shown in WD
e) The root gap to be checked and recorded. Refer clause 22.0
f) Root mismatch shall be checked and recorded. Refer clause 22.0

13.2 PIPING ERECTION

a) After Incoming material inspection, the pipes are to be painted as per the approved grit blasting and painting procedure I46.KK34.0.0.CC.WPR.WD020.
b) Pipes have to be carefully handled and shifted from painting shop to erection area. PP belts shall be used to avoid damage of pipe and its paint.
c) Rollers/trolley/pipes shall be used to lead the pipes inside building. Precaution shall be taken to avoid damage of painting.
d) These pipes are to be lowered based on the area of work front available. The KKS & block numbers shall be identified accordingly
e) Check the correctness of pedestals and Eps with reference to the civil handing over protocols and WDs. Deviation of more than 30nm shall be reported to ENC/NPCIL.
f) Pipes are to be placed over temporary supports.
g) During fit-up, joints are aligned using hydraulic jacks or with chain pulley blocks at both ends of the pipe with wooden sleepers/ structural materials for packing.
h) Root gap and root mismatch shall be within the acceptance criteria mentioned under clause 22.0
i) Positioning of pipelines, supports, and valves shall be maintained as per the drawing with a tolerance of 50mm.
j) Nozzle orientation shall be checked as per drawing.
k) Permanent supports to be erected. Incase of non availability of permanent supports, temporary supports may be erected.
l) Ensure all the supports are installed as indicated in the drawing.
m) Plates/shims shall be provided to make up the gap, if any, between support pedestals and supports (applicable only for supports resting on pedestals)
n) Slope of 1-2mm/M shall be maintained towards the drain points. Incase of non availability of drain points, slope shall be towards flanged connections.
o) After fit up and alignment, the joint shall be cleared for welding. Qualified welder shall carry out welding as per approved QP and WPS.
p) After welding, NDT shall be carried out as per WD requirement.
q) Coating of field joints shall be carried out after successful completion of NDT. If there is delay in application of field joint coating, preservative paints/grease shall be applied in the area of joints and its vicinity where there is no coating. Preservation of welded joints shall be carried out within 2 weeks of welding.
r) Hydro test shall be conducted for entire circuit as approved by NPCIL. After satisfactory completion of hydro test, final hook up joint with the related equipment shall be completed. 100% RT shall be carried out for those joints which are not covered under hydrotest.
s) Final joints with rotary equipment shall be carried out after completion of floating.

t) Check the gap available for thermal expansion and insulation from nearby structure. Report to ENC/NPCIL in case of issue.

u) While erecting valves on pipelines, ensure the following.
   i) The tag number of valves, nominal bore, valve grade, direction of flow is to be checked
   ii) Valve test report to be verified before erection of valves in position.

v) Ensure valves do not foul with existing platforms / or with other pipe lines during their operation and maintenance.

13.3 WELDING OF PIPING JOINTS:

a) Welding procedure is to be qualified before start of welding operation.

b) Welder qualification shall be as per approved procedure I46-KK34-0-0-QAP-QFS-WD001.

c) Joint identification code and joint numbers have to be given for each piping system as per the approved procedure I46-KK34-0-0-CC-WPR-WD021. The joint numbers should be given along the flow direction. The joint numbering has to be incorporated into as per isometric drawing for easy identification and reference.

d) Joint codification shall be carried out as per the approved procedure I46-KK34-0-0-CC-WPR-WD021.

e) Wherever root welding is done with GTAW, the purity of argon gas used should be minimum of 99.987%. Test certificate shall be available for the same.

f) NDT shall be done as per WD requirement

g) Details of welding process for CS piping is detailed in the section 14.

h) All the records of the weld joint shall be maintained as per the format mentioned in clause 24.0

13.4 ERECTION OF PIPING SUPPORTS:

(a) While erecting the pipeline hangers/supports, the location of the hangers/supports is to be ensured.

(a).1 – location of supports shall be checked from the terminal point to the nearest supports or from center of bend to the nearest support.

(b).2- Location of subsequent supports will be checked with reference to the location of supports with reference to (a).1

(c).3 – Tolerance of 100mm shall be allowed for the location of supports.

(b) The hanger/support tag number is to be identified with reference to the drawings of the system.

(c) Elevation shall be checked. Minor deviation in elevation upto 50mm shall be allowed to maintain the slope, if required.

(d) Before erecting the spring cages /Constant Load Hanger, the cold compression value as per design to be ensured with respect to the drawing/document. The hanger should be erected with the spring in locked condition at the cold value. These are to be released only

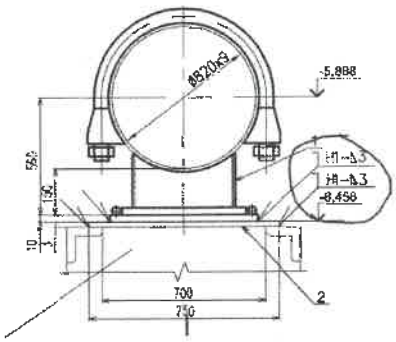
during floating or after completion of hydraulic test and the system is released for commissioning.

(e) While erecting the suspension arrangement, it is to be ensured that inclination of the suspension is to be maintained as per working document. Inclination will be checked with plumb bob and tape.

(f) While erecting the hanger components, the following details are to be ensured.

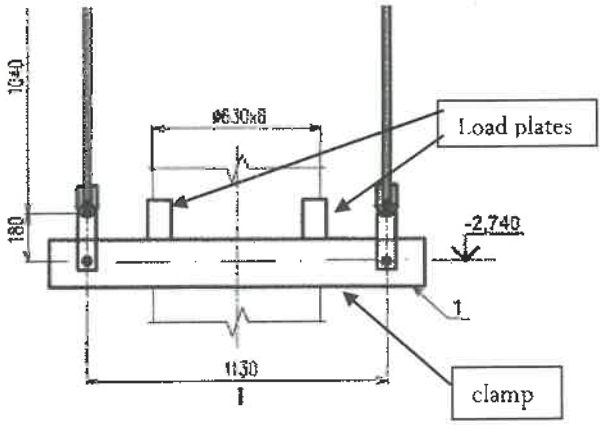
1. Welding detail of hanger and supporting structures shall be as shown in the WD. Typical example shown in table 1.
2. Maintain gap of 15-30mm in the turn buckle for tightening of hangers.

Table 1



(g) While fixing clamps on vertical lines, ensure the load plates are welded on the pipe such that the pipe loads are transmitted directly to the clamps. The clamp shall be loaded on all the load plates. Refer table 2

Table 2



(h) On releasing the hanger locks during floating, the cold set values of adjacent hangers may get disturbed. This has to be corrected by process of reiteration till the correct setting value is achieved in all the hangers. Refer corresponding Wds for the cold set values of spring hangers.

(i) While setting the hanger for cold /hot values it should be ensured that the design values are obtained as per WD. For any deviations of beyond +/-10mm, designer approval is to be taken.

(j) For restraints /guides/anchors, the gaps shall be uniformly maintained.

(k) During Hydro test, the springs of supports should not be loaded.

(l) When the unit is running on full parameters the hot value of the spring supports has to be recorded.

(m) After completion of piping erection including supports, the deviations from the drawing if any, are to be incorporated in the as built drawing.

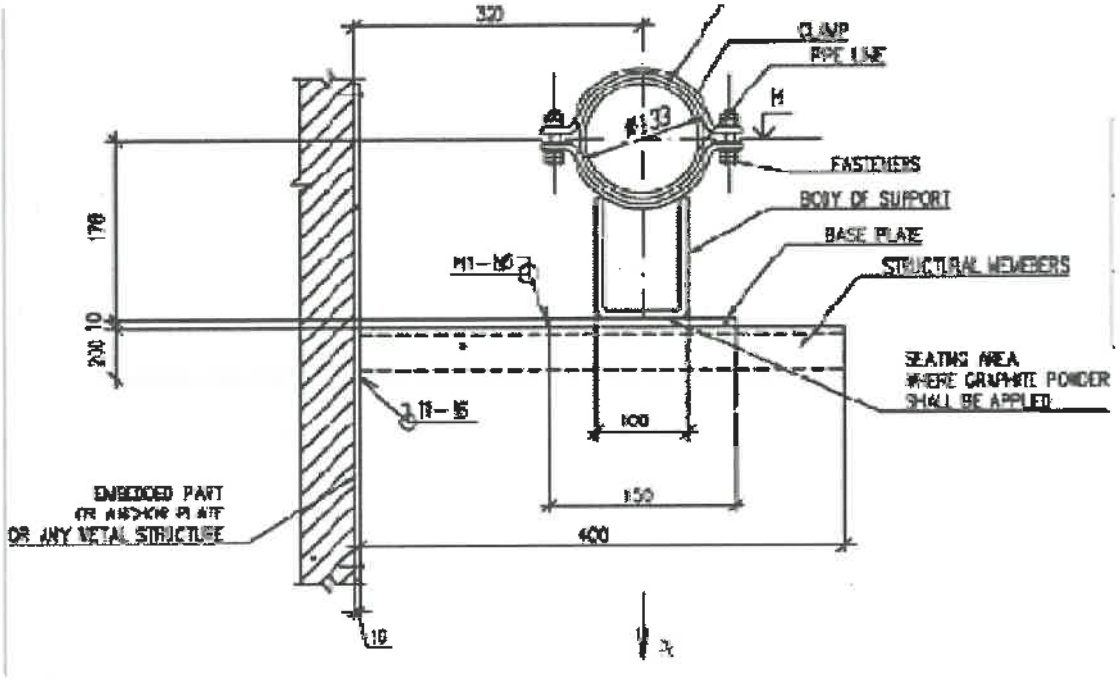
(n) After completing hydro test and normalization, springs are to be released. The spring values shall be recorded and to be compared with the design values. Deviation beyond +/-10mm shall be reported to designer for concurrence.

(o) There shall be an additional check to ensure thermal compensation by re checking of first support from the main branch, if the size of the pipe from the branch is 80Nb and below.

13.5 SPECIFIC GUIDELINES FOR DIFFERENT TYPES OF SUPPORTS:

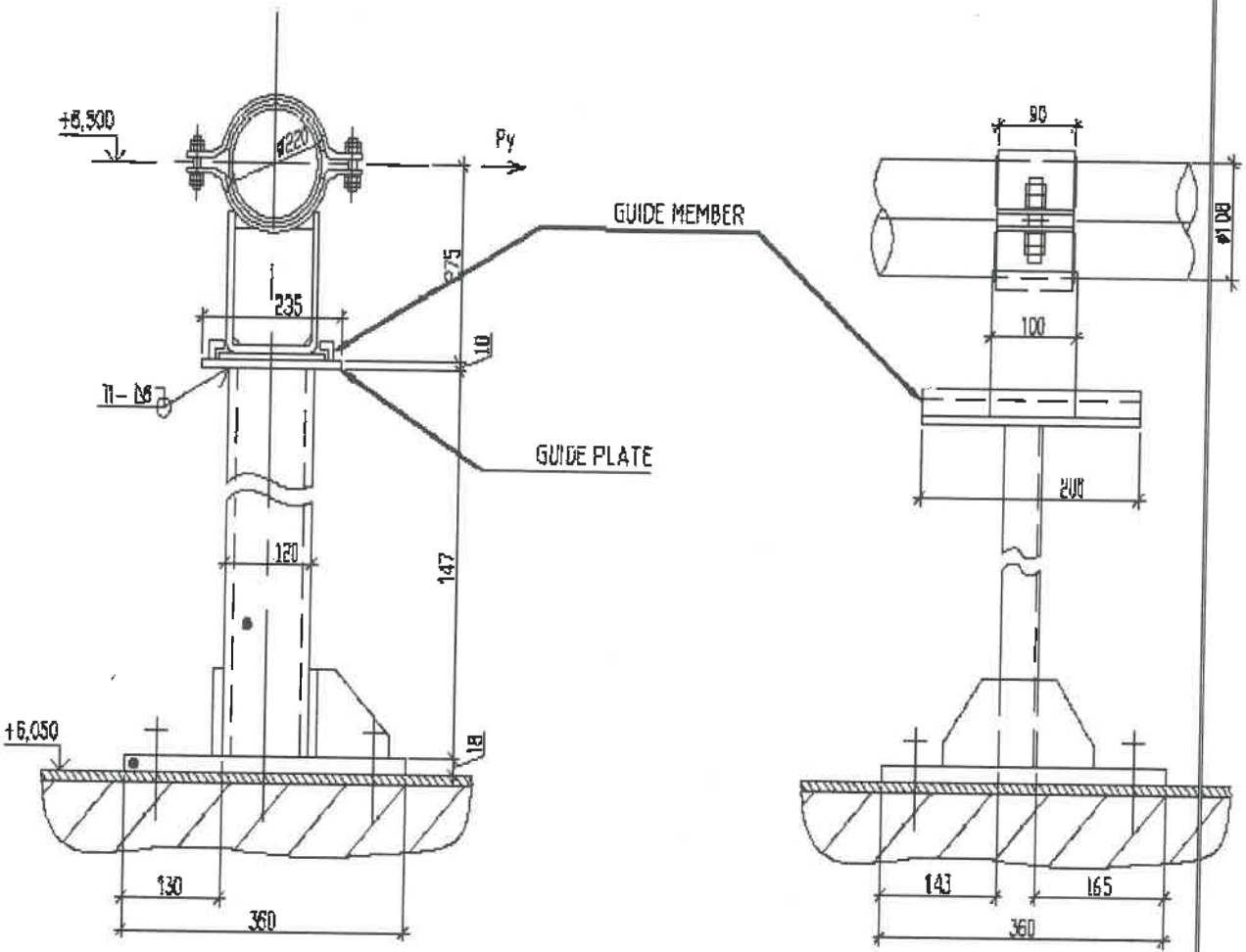
13.5.1 SIMPLE SLIDING SUPPORT:

1. Simple sliding supports are dead-weight supports i.e. they simply rest on the support structure. They consist of shim, clamp, fasteners, body of support, base plate and structural members (refer the image below) –
2. The body of support, designated by with Russian standards, shall be carefully selected to avoid mismatch.
3. Body of support shall rest on the base plate.
4. After completion of erection, graphite powder shall be applied between the contact surfaces.
5. Welding of saddle to the pipeline shall be carried out carefully to avoid any damage to the pipeline.



13.5.2 SLIDING GUIDE SUPPORT/GUIDE SUPPORTS:

1. In addition to the parts covered in simple sliding supports, Guide supports have an additional member called guide plate (refer image below) –
2. The guide plates are welded on to the supporting structure and the body of support rests on the guide plate, within the guide.
3. There shall be free movement between the body of support and the guide plates.
4. Ensure that body of support rests on the base plate. Also, graphite powder shall be applied on the mating surfaces.
5. Uniform gap shall be maintained between the guide members and the body of support.
6. Horizontal pipelines are provided with single guide plate while vertical pipelines will be provided with double guide plates.

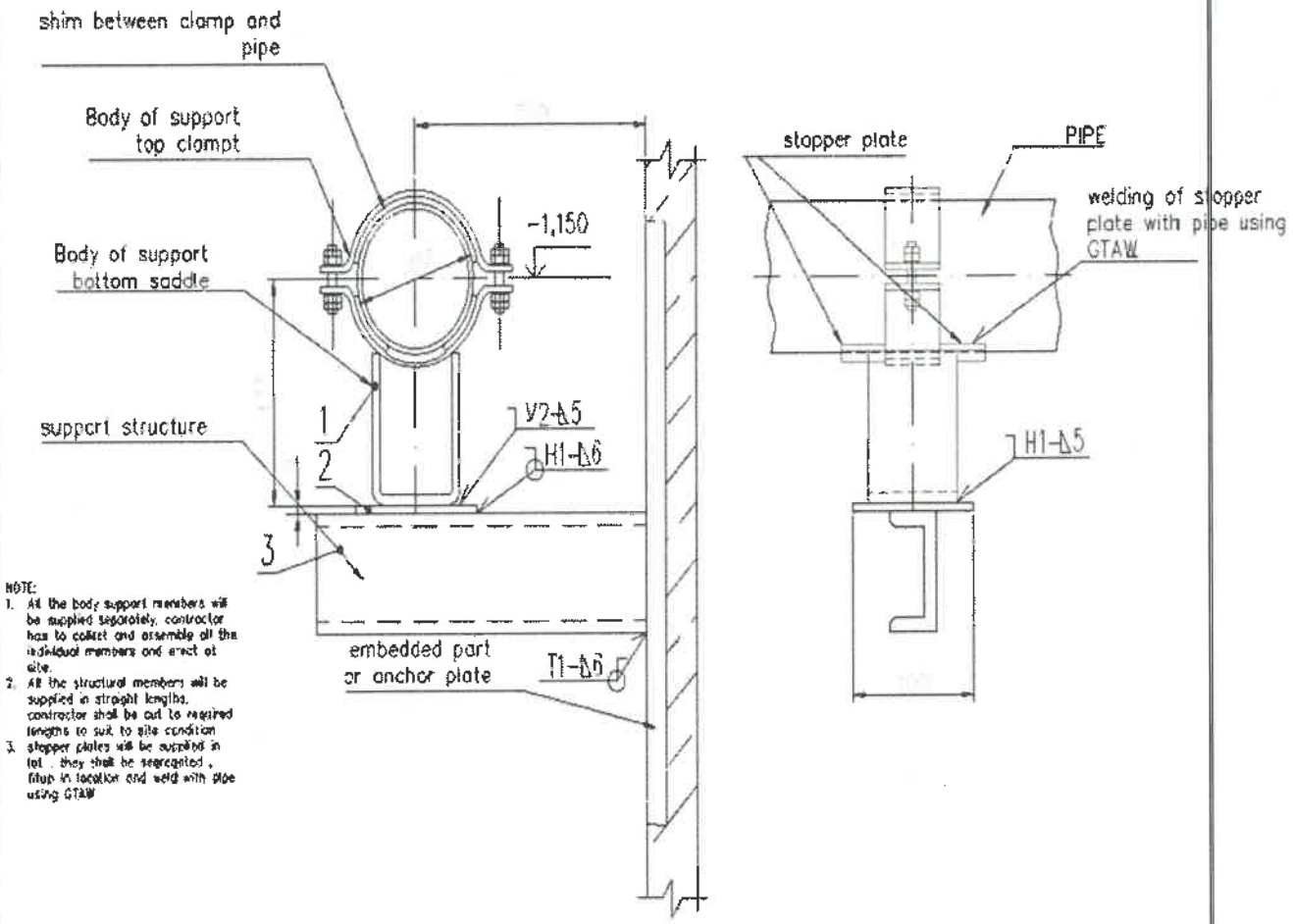


	Prepared by	Reviewed by	Reviewed by	Approved by	Issued by
Name	Kartik P	Muhammed Quraish A.V.M	Shashi Kant Saini	Sanjiba Nanda Naik	R. Thanasekaran
Designation	Dy.Manager	Manager - SCP	Manager – Quality	Site Incharge	Document Controller
Signature					
Date	16.12.2022	16.12.2022	16.12.2022	16.12.2022	16.12.2022

13.5.3 FIXED OR IMMOVABLE SUPPORT:

In Fixed Supports, the movement of the body of support is restricted in all directions. This is achieved by welding the body of support to the pipelines and the structural member (refer the image below) –

TYPICAL SKETCH OF FIXED SUPPORT



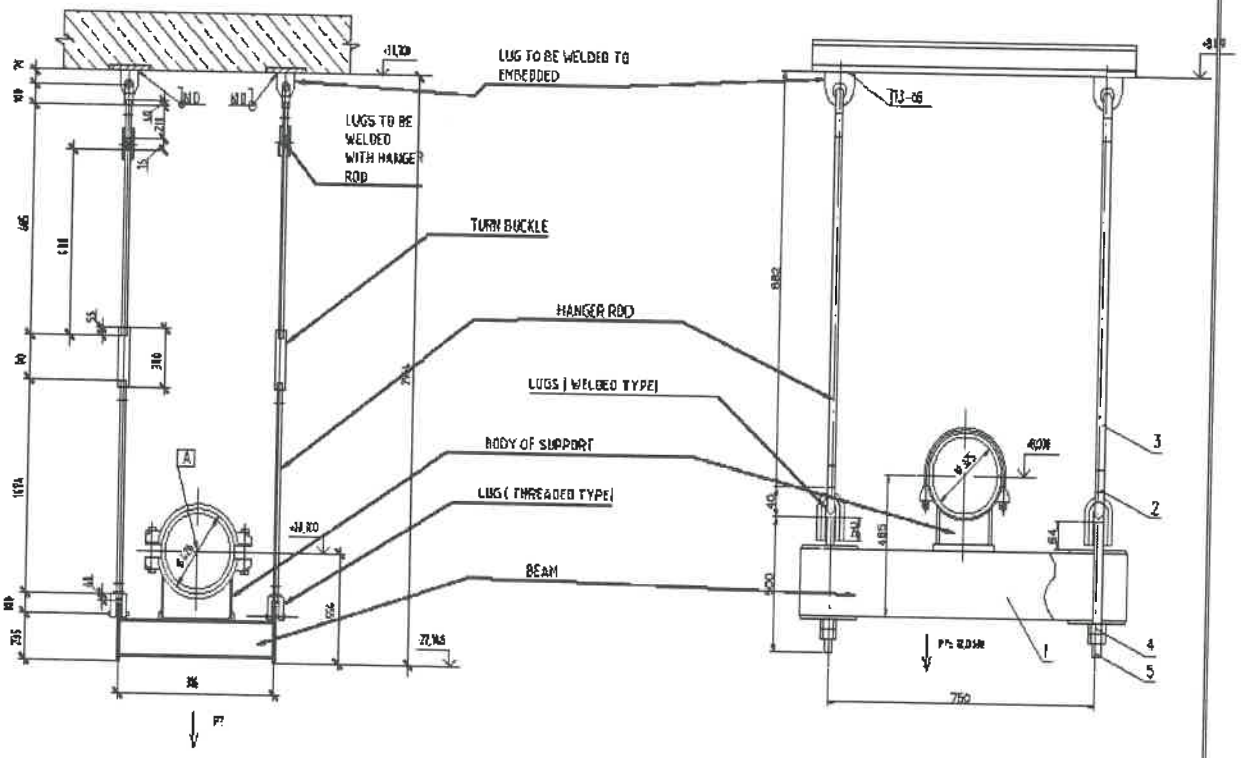
1. The body of support is directly welded to the resting plate. Additionally, stopper plates are welded on the pipe surface adjacent to the support bottom clamp on either side of the support to restrict relative movement of the pipe, making the support fixed.
2. Material of stopper plates is similar to the pipe parent material. These stopper plate will be welded using GTAW process.

3. For small bore pipe supports, body of support shall be directly welded to the pipe, without any clamps. This welding shall be carried out by GTAW process, taking care not to damage the pipe.

13.5.4 RIGID HANGER SUPPORTS:

1. Hanger supports are used for both horizontal and vertical runs of pipes. They can be of single or double rod type.
2. Hanger supports have following additional components viz. lugs, rods (supplied in straight length, also dia. May vary from 8 mm to 40 mm), turn buckles, support clamps, fastening clamps, eyes (dia. From 8 mm to 40 mm) etc. (refer image below) –

TYPICAL ARRANGEMENT OF HANGER SUPPORT



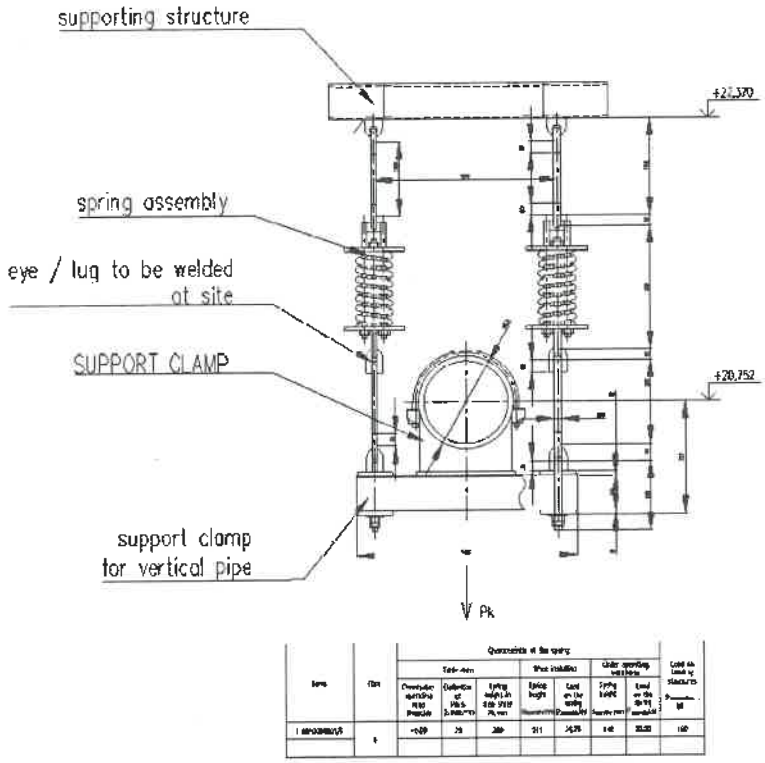
3. The hanger support erection shall be planned and sequenced to ensure loading of all hangers.
4. For hanger supports with turnbuckle, care shall be taken to ensure use of correct turnbuckle for the particular support.

5. Rods shall be cut and ground as per the field measurement; all the clamps and the eyes shall be segregated, eyes shall be welded to the rods and shall be assembled at site with clamp and the supporting member. The supporting member may be an embedded part or a metal structure.
6. In case of erection of hanger supports in location, utmost care shall be taken to ensure tightness of hangers. Hanger shall be loaded by adjusting the turn buckle.

13.5.5 SPRING HANGER SUPPORTS:

1. The main components of spring hanger supports are body of support, clamps, supporting beam, hanger rods, eyes / lugs, shims, spring assembly etc. (refer images below) –
2. The Spring hanger supports are supported from embedded parts, anchor plates or on the nearest metal structure and may be mounted on vertical or horizontal pipe runs.
3. Rods are to be cut and ground as per field measurements and lugs / eyes shall be welded to the rods.

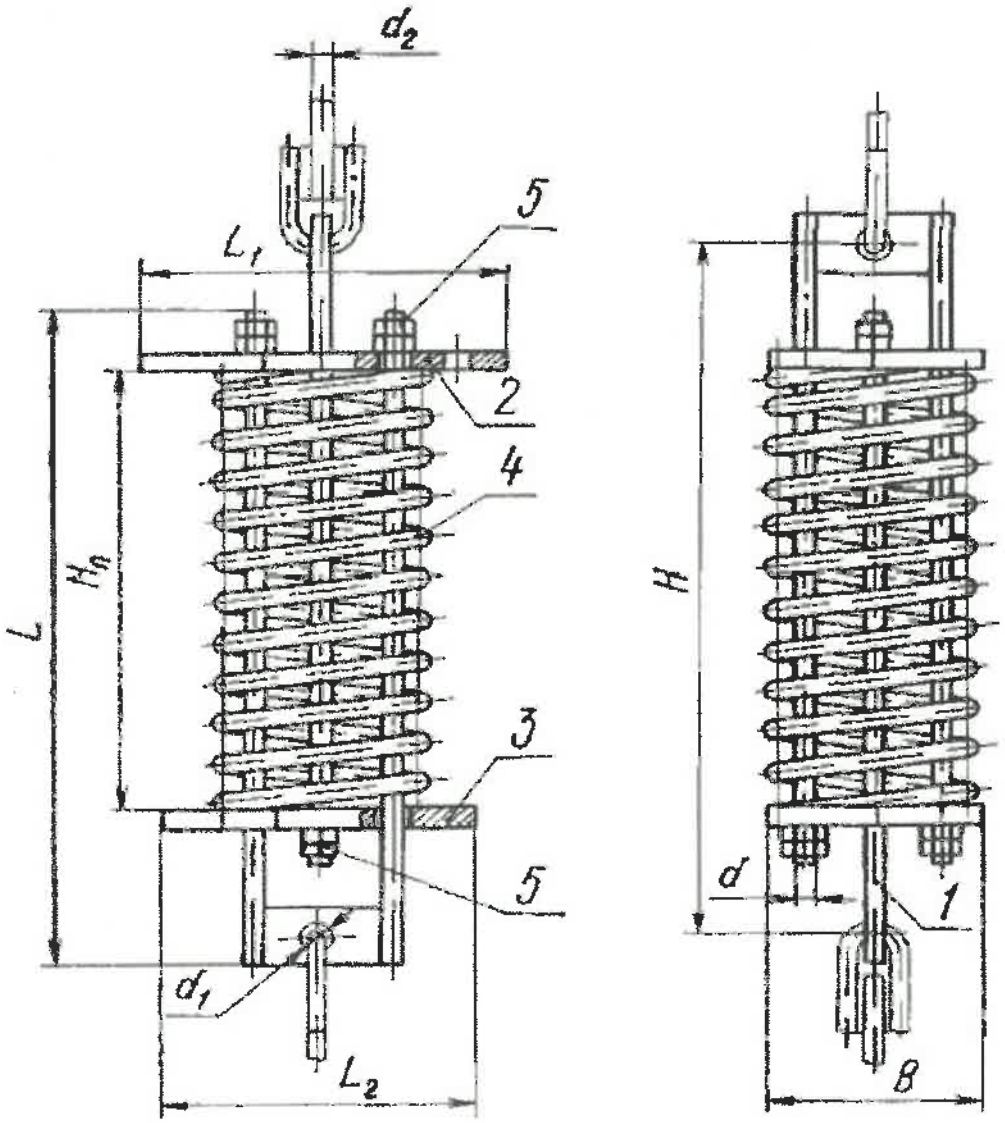
SPRING HANGER IN HORIZONTAL LINE



13.5.6 SPRING ASSEMBLIES:

1. Spring assemblies are classified based on the stiffness, compression, free height of the spring and identified by unique Russian standard. They are not interchangeable. (refer image below)
2. The spring tag number is to be identified w.r.t drawing of the particular system.
3. All spring hanger supports have a requirement of spring heights to be maintained during erection and during operation.
4. All springs (supplied in free state) shall be checked for dimension of free height, wire diameter etc. before assembling, as per applicable WDs and OST standards.
5. All the parts of the spring assembly support are segregated and the springs are assembled with the respective spring plates and rods using fasteners.
6. Springs shall be assembled and dimensions shall be set as per the approved drawings.
7. A jig / fixture shall be fabricated so that the spring assembly can be pre-compressed and locked to the required dimension, as per WD requirements, before taking to site for erection.
8. Lock of the springs shall be released only during floating or after the completion of hydraulic test by getting clearance from ENC/NPCIL. If the spring height is found to vary after releasing of lock, it shall be readjusted. Post this, the assembly may be erected and welded.
9. For vertical pipelines, spring assemblies will be provided with stopper plates (supplied as free issue) for taking the load of the pipe. These plates shall be welded to the pipe using GTAW process.
10. Arrangement of typical spring support assembly on horizontal and vertical pipelines is given below –

TYPICAL SPRING ASSEMBLIES

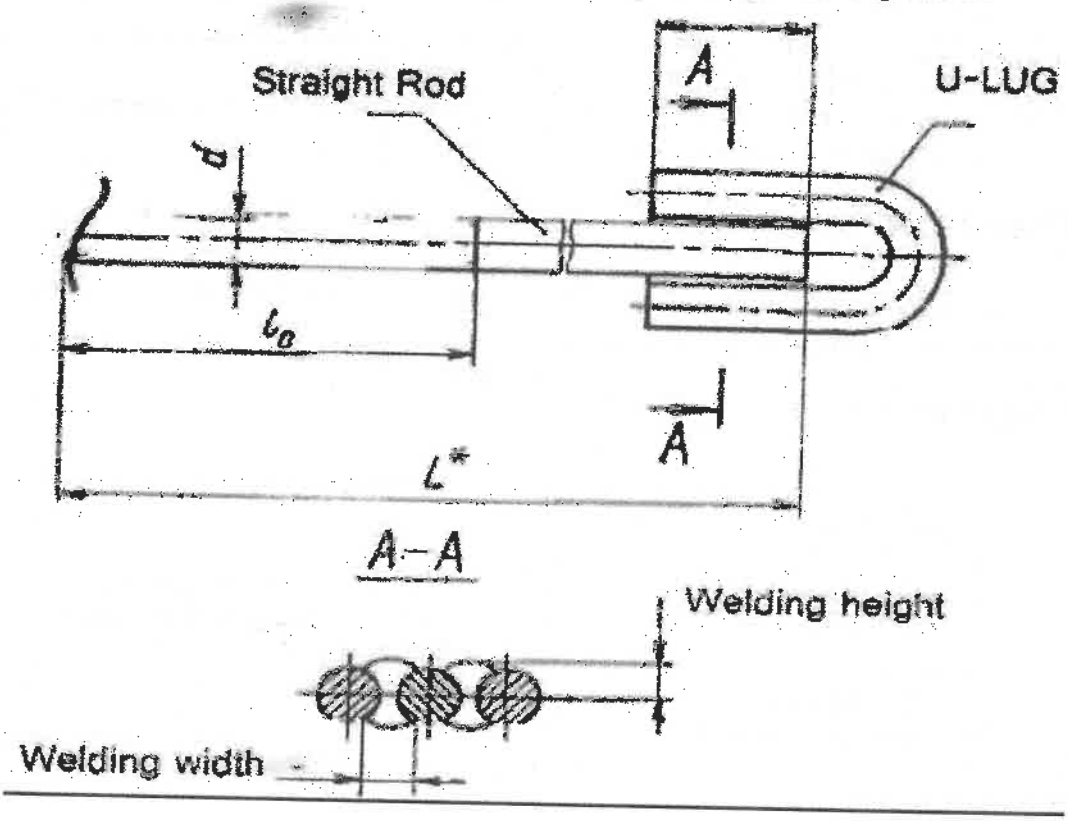


1) Clamping Rod 2) Spring locking plate 3)Spring locking plate 4) Spring

5) Lock Nut

	Prepared by	Reviewed by	Reviewed by	Approved by	Issued by
Name	Kartik P	Muhammed Quraish A.V.M	Shashi Kant Saini	Sanjiba Nanda Naik	R. Thanasekaran
Designation	Dy.Manager	Manager - SCP	Manager – Quality	Site Incharge	Document Controller
Signature					
Date	16.12.2022	16.12.2022	16.12.2022	16.12.2022	16.12.2022

Arrangement of LUG & ROD Welding Arrangement



13.5.7 TORQUE TIGHTENING:

I. All bolts shall be engaged so that there is visible evidence of complete threading through the unit or thread attachment at least two threads shall be projected beyond unit.

II. In bolting of gasket flanged joints 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.

III. Torque value will be incorporated in the procedure after obtaining the values from M/s NPCIL. Hence torque tightening is excluded from the scope of this procedure.

13.6 PRECAUTIONS DURING SUPPORT ERECTION:

1. Even though diameter and supports are same for pipes of different systems, mixing of supports must be avoided.
2. Care shall be taken while welding stopper plates. The small bore pipe supports shall not be directly welded to pipe; as there is a risk of puncturing the pipe.

13.7 VALVE TESTING:

All valves are to be tested for leak tightness prior to installation. Valve testing shall be done at Valve testing facility available at site as per approved procedure I46.KK34.0.0.QA.QFS.WD031.

13.8 VALVE ERECTION:

(1) Various types of valves are to be mounted in the process system piping as wedge valves, butterfly valves, ball valves, swing check valves.
(2) Valves shall be identified with KKS and tag nos.
(3) Valves shall be transported to the installation site in manufacturers' packing
(4) Name plate details on the valves to be checked. Size, ratings shall be compared with WD parameters. Non conformity shall be reported to M/s NPCIL.
(5) Physical damage, if any, shall be reported to ENC/NPCIL
(6) Ensure passport during installation of valves

13.8.1 WEDGE GATE

(7) Valves can be installed on horizontal and vertical pipelines.
(8) The dimensions of the pipes to be joined with the valves are specified in TU-AS00-001-AG-2008
(9) Valves are required to be erected in horizontal pipeline, vertical pipeline or in any other orientation as per the requirement specified in the working drawing and valves to be erected as per the flow direction mentioned in the body of valve.
(10) Before welding, partially open the wedge.
(11) Foreign particles, debris, if any, shall be removed before carrying out fit up and welding of valves
(12) The fastening material, plugs, caps on the valves and accessories not to be opened and loosened without NPCIL approval

(a) All machined surfaces shall be protected from dust and mechanical damages.
(b) All the thread connection shall be either capped or have threaded plugs.
(c) Incase of ovality of pipeline, the same shall be corrected during fit up.
(d) Utmost care shall be taken while carrying out fit-up of piping connection with static and rotary equipment nozzle so that no welds spatter fall inside the equipment and no stress concentration between the equipment nozzle and pipeline.
(e) The areas from which temporary attachments to be removed shall be dressed smooth and shall be examined by LPT.
(f) Pipes shall be cleaned before fit-up to ensure that there are no foreign materials.

14.2 WELDING

a) All welding procedures shall be qualified.
b) Electrodes /filler wires that are accompanying piping only to be used. In case of using from other brand electrodes /filler wire, ENC/NPCIL approval shall be taken.
c) MTC for welding & NDT consumables supplied by M/S BHEL shall be available prior to usage and incoming inspection shall be completed.
d) No welding shall be done on surface, which are wet or exposed to rain.
e) Haphazard striking of electrode on the base metal in establishing the arc shall not be permitted.
f) Starting of arc in GTAW welding shall be done from high frequency attachment to avoid damage to the parent metal.
g) Sequence of application of beads / layers, category and profile of joints shall be ensured.
h) Peening shall not be allowed.

14.3 CONSUMABLE CONTROL

a) The electrodes / filler wire shall be as specified in the working document.
b) Only NPCIL approved brands of electrode and filler wires shall be used.
c) Welding consumable and electrodes shall be controlled and recorded in the register.
d) Baking register with details of electrode batch certificate, in time, out time, quantity to be maintained
e) Reconciliation of the electrodes to be carried out every day

14.4 ELECTRODE STORAGE AND MOISTURE CONTROL

Electrode storage and Moisture control is as per approved procedure I46-KK 34/O/O/WPR/ WD006.

14.5 WELDING TECHNIQUE

14.5.1 Starting the Arc

a) Before striking an arc on a previously deposited bead using the SMAW process, the first deposit should be cleaned of any slag present by use of chipping hammer and SS wire brush.
b) If the previous bead has a convex face, it is particularly important to remove particles of slag from the hollows along the edges of the bead. Starting points can be grounded.
c) If required for this purpose, filling of arc crater shall be done before the arc is removed from the root pass.

14.5.2 OPERATING POSITION AND ARC MANIPULATION

a) Welding shall be carried out in the flat position wherever possible, because it is faster and easier.
b) Arc manipulation shall ensure full penetration, full fusion, uniformity of bead surface and floating of slag, oxide gases.
c) Covered electrode shall be tilted in the direction of welding (forehand). In general, the inclination angle is 45^0.
d) Short arc length shall be employed to minimize oxidation of elements such as chromium, silicon, manganese and columbium and to improve corrosion resistance and mechanical properties of weld metal.
e) Weaving the electrode during welding should be carefully controlled.
f) Stringer bead technique shall be used with a slight oscillation if necessary to avoid entrapped slag.
g) A slight transverse oscillation shall be employed to avoid entrapped slag along the groove and to minimize the number of beads needed to fill a joint.
h) However, if the weaving motion is excessive, the molten pool may not be adequately protected by the shielding medium at all times.
i) In SMAW process, the weave width shall not exceed three times the electrode diameter.
j) Haphazard striking of the electrode on the base metal in establishing the arc shall not be permitted. If required starting plate can be used (same material). Arc strike shall be removed by grinding and checked by PT for defects

14.5.3 WELD SIZE AND CONTOUR

a) A wide bead with a concave face shall not be generally employed for welding.
b) This shape will have a greater tendency to produce longitudinal hot cracking in the center of the bead comparing stringer bead with a flat or convex face.

c) Heavy weld reinforcement of a butt joint or a sharp change in section thickness between weld and base metals shall be avoided in order to minimize the stress concentration at the toe of the weld.
d) Since the strength of the weld metal is exceeding that of the base metal, the reinforcement shall be maintained to a minimum.
e) Overlap or undercut shall not be present.

14.5.4 WELDING CURRENT AND TRAVEL SPEED

a) Relevant standard and manufacturer recommendation shall be followed for current range and travel speed.
b) GTAW electrode shape at tip shall be pointed for DC welding and spherical for A/C welding.
c) Welding torch shall be slightly inclined in the forehand welding position.
d) If tungsten contamination occurs during welding. Arc shall be eliminated and defect shall be grinded out.
e) Electrode extension (beyond gas cup) shall be kept as short as possible.
f) GTAW process shall be used with DCEN polarity.
g) SMAW process shall be used with DCEP polarity.
h) Weld Technique (process) shall be monitored and controlled by controlling above variables.

14.5.5 WELD VISUAL

a) The root pass shall be visually examined and shall be free from defects such as pores, crack.
b) The final pass of welding shall be inspected for completeness, reinforcement, overlaps, pinholes, undercuts, cracks and it shall be made free of defects.
c) Acceptance criteria for weld visual shall be as per RF codes.
d) All welded joints shall be adequately punched/engraved, on the outer side of welded joints at a distance of 30 to 50 mm from the weld reinforcement edge. The size of metal stamp shall be 6 to 12 mm. The depth the punch shall be 1mm. Punching details shall contain joint no, Line no and welder ID.
e) Separate register shall be maintained for joint no, Line no, welder ID who is welding the joint.

14.5.6 NDT

a) NDT as applicable and mentioned in the WD's shall be performed as per the approved drawings and procedures. Quantum of checks for different NDT methods shall be as per the WDs.

b) Visual and Measuring examination as per approved work procedure - I46-KK34-0-0-QA-QFS-WD004.
c) Dye Penetrant Test as per approved work procedure – I46-KK34-0-0-QA-QFS-WD003.
d) RT as per approved work procedure-I46-KK34-0-0-QA-QFS-WD007.
e) UT as per approved work procedure-I46-KK34-0-0-QA-QFS-WD016.

14.5.7 REPAIR OF WELDS

Defects found during any of the NDT methods shall be repaired as below:

a) The surface defects should be corrected mechanically with provision for continuous transition in the areas of the grooves by abrasive tools, cutting or chipping with subsequent grinding.
b) Defects in root shall be removed by grinding and welding shall be carried out from outside of the pipe.
c) In case of slag inclusion, slow grinding will be done till complete removal of slag. Visual / RT inspection shall be carried out to ensure complete removal of slag as per standards.
d) The Re-welded area shall be re-examined by the methods specified for original welds.
e) Where radiography is required, a minimum amount of 50mm-film overlap beyond the repair edges shall be ensured.
f) Maximum times of repairs permitted is 2 times. Repair means when weld is gouged & re-welded.

15.0 FME INSPECTION

After completion of all the activities pertaining to piping erection, welding and NDT, FME inspection to be carried out as per approved work procedure for FME inspection I46-KK34-0-0/CC/WPR/WD005.

16.0 FLUSHING OF PIPELINE

After completion of FME inspection, flushing of pipeline to be carried out as per approved work procedure for flushing of pipeline I46-KK34-0-0/CC/WPR/WD028.

17.0 HYDRAULIC TESTING

a) Hydraulic test loops have to be identified from P&I diagrams covering same test pressure.
b) The hydraulic test pressure should be as indicated in the drawing.
c) Necessary blanking of piping has to be done wherever is required.
d) Wherever isolation valves are available, the hydraulic test can be performed with the valves as test boundary. During HT, all hangers are to be locked and subsequently the same is to released after hydro test.
e) Hydrotest shall be as per the procedure I46-KK-34-0-0-CC-WPR-WD030.

18.0 FLOATING OF PIPING

a) Piping systems have to be floated after completion of permanent supports, drains and vents. After completion of all welding, the pipelines have to be connected with critical equipment like turbine and feed pump etc.
b) The load of the piping system has to be taken on hangers after releasing the locking.
c) The springs have to be adjusted by tightening/loosening the turn buckles.
d) The restrain supports of the piping also may require adjustment.
e) The joints with equipment should freely match, without any significant load.
f) Once the free joint is obtained and the joint fit up is done, the springs may be locked and the joint is to be welded in arrested position.

19.0 RE-PRESERVATION

After completion of hydro-test of pipeline, re-preservation to be carried out as per approved work procedure for de-preservation and re-preservation of pipeline I46.KK34.0.0.QA.QFS.WD 006

20.0 ERECTION COMPLETION & SUBMISSION OF CRR:

1. After completion of erection activities including welding, the entire piping system shall be checked for the conformity with reference to scheme and WDs
2. Hydrotest loops to be identified based on the system readiness and matching test pressures. Proposal with as built drawings of testing loops shall be submitted for approval of ENC/NPCIL along with details of test pressure, test medium, leak search pressure, test duration.
3. Compilation all the loop wise reports such as line erection report, weld joint history sheet, support erection report, valve erection reports, list of terminal points, list of exemption if any shall be completed

21.0 INSPECTION AND ACCEPTANCE:

- Inspection activities shall be carried out as per approved QP-I46.KK34.0.0.QA.QP-WD026

22.0 ACCEPTANCE CRITERIA

22.1 FITUP

a) ID mismatch

SL.NO	Thickness (mm)	Maximum permissible displacements (mm)
1	5	1
2	6	1.1
3	8	1.3
4	10	1.5
5	12	1.7
6	14	1.9
7	16	2.1
8	18	2.3
9	20	2.5
10	24	2.9

b) Root gap – As per the type of joints & standards mentioned in the Wds

22.2 WELDING

22.2.1 Root Concavity

When welding the swiveling butts of piping parts without backing rings, it is permitted to have a continuous or intermittent concavity of the weld root on the internal side not exceeding the following dimensions:

SL.NO	Rated thickness of pipe wall thickness (in mm)	Permissible height (depth) of root concavity of weld root (in mm)
1	From 1.0 to 1.8 mm inclusive	0.2
2	Over 1.8 to 2.8 mm inclusive	0.4
3	Over 2.8 to 4.0 mm inclusive	0.6
4	Over 4.0 to 6.0 mm inclusive	0.8
5	Over 6.0 to 8.0 mm inclusive	1.0
6	Over 8.0 to 12.0 mm inclusive	1.2
7	Over 12.0 mm inclusive	1.5

23.0. JOB HAZARD ANALYSIS:

a) Approved procedure for Scaffolding work shall be followed as per I46/KK34/0/0/OT/JHA/WD001.
b) Approved procedure for Materials Transportation shall be followed as per I46/KK34/O/O/OT/JHA/WD002.
c) Approved procedure for Hot work (Welding, grinding) work shall be followed as per I46/KK34/0/0/OT/JHA/WD001.
d) Approved procedure for Height work shall be followed as per I46/KK34/0/0/OT/JHA/WD009.
e) Approved JHA procedure for carrying out Radiography testing as per I46/KK34/O/O/OT/JHA/WD012.

24.0. FORMATS

Formats as per approved QP

25.0. ENCLOSURES

a) Annexure A – List of Applicable WDs

ANNEXURE A		
Applicable WDs		
SL.NO	SYSTEM KKS	WD REFERENCE
1	LAA	R01.KK34.30/40UMA.LAA.TM.OK.WD001
2	LAB	R01.KK34.30/40UMA.LAB.TM.OK.WD001
3	LAB	R01.KK34.30/40UMA.LAB.TM.OK.WD002
4	LAB	R01.KK34.30/40UMA.LAB.TM.OK.WD003
5	LAD	R01.KK34.30/40UMA.LAD.TM.OK.WD001
6	LAD	R01.KK34.30/40UMA.LAD.TM.OK.WD011
7	LAH	R01.KK34.30/40UMA.LAH.TM.OK.WD001
8	LAH	R01.KK34.30/40UMA.LAH.TM.OK.WD002
9	LBA	R01.KK34.30/40UMA.LBA.TM.OK.WD001
10	LBG	R01.KK34.30/40UMA.LBG.TM.OK.WD001
11	LBG	R01.KK34.30/40UMA.LBG.TM.OK.WD002
12	LBG	R01.KK34.30/40UMA.LBG02.TM.OK.WD001
13	LBG	R01.KK34.30/40UMA.LBG02.TM.OK.WD002
14	LBG	R01.KK34.30/40UMA.LBG11.TM.OK.WD001
15	LBG	R01.KK34.30/40UMA.LBG11.TM.OK.WD002
16	LBG	R01.KK34.30/40UMA.LBG11.TM.OK.WD003
17	LBG	R01.KK34.30/40UMA.LBG11.TM.OK.WD004
18	LBG	R01.KK34.30/40UMA.LBG13.TM.OK.WD001
19	LBG	R01.KK34.30/40UMA.LBG90.TM.OK.WD001
20	LBG	R01.KK34.30/40UMA.LBG90.TM.OK.WD002
21	LCA	R01.KK34.30/40UMA.LCA20.TM.OK.WD001
22	LCA	R01.KK34.30/40UMA.LCA20.TM.OK.WD002
23	LCA	R01.KK34.30/40UMA.LCA70.TM.OK.WD001
24	LCA	R01.KK34.30/40UMA.LCA70.TM.OK.WD002
25	LCB	R01.KK34.30/40UMA.LCB11.TM.OK.WD001
26	LCH	R01.KK34.30/40UMA.LCH.TM.OK.WD001
27	LCM	R01.KK34.30/40UMA.LCM.TM.OK.WD001
28	LCM	R01.KK34.30/40UMA.LCM.TM.OK.WD002
29	LCM	R01.KK34.30/40UMA.LCM.TM.OK.WD003
30	LCN	R01.KK34.30/40UMA.LCN.TM.OK.WD001
31	LCS	R01.KK34.30/40UMA.LCS.TM.OK.WD001
32	LCS	R01.KK34.30/40UMA.LCS50.TM.OK.WD001
33	LCT	R01.KK34.30/40UMA.LCT51.TM.OK.WD001
34	LDB	R01.KK34.30/40UMA.LDB.TM.OK.WD001
35	LDN	R01.KK34.30/40UMA.LDN.TM.OK.WD001
36	LDR	R01.KK34.30/40UMA.LDR.TM.OK.WD001
37	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD001
38	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD002
39	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD003
40	PAB	R01.KK34.30/40UMA.PAB90.TM.OK.WD001
41	PAS	R01.KK34.30/40UMA.PAS.TM.OK.WD001
42	PGB	R01.KK34.30/40UMA.PGB10.TM.OK.WD001
43	PGB	R01.KK34.30/40UMA.PGB21.TM.OK.WD001
44	PGB	R01.KK34.30/40UMA.PGB21.TM.OK.WD002
45	PGB	R01.KK34.30/40UMA.PGB40.TM.OK.WD001
46	PGB	R01.KK34.30/40UMA.PGB80.TM.OK.WD001
47	PGB	R01.KK34.30/40UMA.PGB84.TM.OK.WD001

ANNEXURE A		
Applicable WDs		
SL.NO	**SYSTEM KKS**	**WD REFERENCE**
48	QJB50	R01.KK34.30/40UMA.QJB50.TM.OK.WD001
49	QJC10	R01.KK34.30/40UMA.QJC10.TM.OK.WD001
50	SCB10	R01.KK34.30/40UMA.SCB10.TM.OK.WD001
51	PGB	R01.KK34.30/40UMV.PGB84.TM.OK.WD001
52	LCG	R01.KK34.30UMA.LCG.TM.OK.WD001
53	LCR	R01.KK34.30UMA.LCR10.TM.OK.WD001
54	LAC	R288.KK34.30/40UMA.LAC.TM.OK.WD001
55	LAC	R288.KK34.30/40UMA.LAC.TM.OK.WD002
56	LAC	R288.KK34.30/40UMA.LAC.TM.OK.WD003
57	LAJ	R288.KK34.30/40UMA.LAJ.TM.OK.WD001
58	LCA	R288.KK34.30/40UMA.LCA23.TM.OK.WD001
59	LCA	R288.KK34.30/40UMA.LCA23.TM.OK.WD002
60	LCA	R288.KK34.30/40UMA.LCA34.TM.OK.WD001
61	LCA	R288.KK34.30/40UMA.LCA34.TM.OK.WD002
62	LCA	R288.KK34.30/40UMA.LCA57.TM.OK.WD001
63	LCA	R288.KK34.30/40UMA.LCA90.TM.OK.WD001
64	LCA	R288.KK34.30/40UMA.LCA90.TM.OK.WD002
65	LCB	R288.KK34.30/40UMA.LCB10.TM.OK.WD001
66	LCB	R288.KK34.30/40UMA.LCB41.TM.OK.WD001
67	LCR	R288.KK34.30UMA.LCR50.TM.OK.WD001
68	LAB	R524 KK34 30/40UMA LAB TU MC WD001
69	LCH	R524 KK34 30/40UMA LCH TU MC WD001
70	LCJ	R524 KK34 30/40UMA LCJ TU MC WD002
71	LCJ	R524 KK34 30/40UMA LCJ TU MC WD003
72	LCJ	R524 KK34 30/40UMA LCJ TU MC WD004
73	LCS	R524 KK34 30/40UMA LCS TU MC WD001
74	LCS	R524 KK34 30/40UMA LCS TU MC WD002
75	LCS	R524 KK34 30/40UMA LCS TU MC WD003
76	LCS	R524 KK34 30/40UMA LCS TU MC WD004
77	LCT	R524 KK34 30/40UMA LCT TU MC WD001
78	LCT	R524 KK34 30/40UMA LCT TU MC WD002
79	LCT	R524 KK34 30/40UMA LCT TU MC WD003
80	LCT	R524 KK34 30/40UMA LCT TU MC WD004
81	LST	R524 KK34 30/40UMA LST TU MC WD001
82	PAS	R524 KK34 30/40UMA PAS TU MC WD001
83	LCA	R524 KK34 30UMA LCA TU MC WD001
84	LCA	R524 KK34 30UMA LCA TU MC WD003
85	LCA	R524 KK34 30UMA LCA TU MC WD004
86	LCA	R524 KK34 30UMA LCA TU MC WD007

न्यूक्लियरपॉवरकॉर्पोरेशनऑफइंडियालिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
(भारतसरकारकाउद्यमA Govt. of India Enterprise)
कुडनकुलमन्यूक्लियरपॉवरप्रोजेक्टKUDANKULAM NUCLEAR POWER PROJECT-3&4

दस्तावेजस्वीकृतिसूचनाDOCUMENT ACCEPTANCE NOTE

Document No	I46	KK34	0	0	CC	WPR	WD007
दस्तावेजशीर्षक Document Title	Work Procedure for SS Piping Erection						
संविदाकारContractor	M/s BHARAT HEAVY ELECTRICALS LIMITED						
कार्यआदेशसं. Work Order No.	400442 dated 05.08.2019						
कार्यकानाम Name of Work	Erection work of Turbine, Generator, Condenser, Secondary cycle & Sea Water System Equipment's and piping including Painting, Insulation, Anti Corrosive Coating and structural steel works in turbine building and sea water structure of KKNPP 3&4						

उपर्युक्तदस्तावेजकीसमीक्षाकीगईहैऔरलागूडब्लूडी, कोडऔरविनिर्देशोंकीआवश्यकताओंकीपुष्टिपाईगईहै।Above document has been reviewed and found conforming to the requirements of applicable WDs, codes and specifications.

गतिविधिActivity	अनुभागSection	नामएवंपदनाम Name & Designation	हस्ताक्षरएवंदिनांक Signature & Date
समीक्षितReviewed by	Mechanical	SUNIL Kumar SAHAI SO/E	7/7/22
		Lenin M SO/E	07/07/2022
सहमत Concurred by	QA	Vasant Bhat SO/E	07.07.2022
	FE	Narinder Kumar SO/E.	D. Narinder 08.07.2022
स्वीकृत Accepted by	Mechanical	G. Siddhartha Kumar ACE(Mech.TG)	08/07/2022

Controlled Copy Distribution List

Sl.No.	Controlled Copy No.	ISSUED TO		
		Department	Responsible Person	Type of Control
M/s NPCIL				
01	01	M/s NPCIL MECH	ENC/TSS PACKAGE	CONTROL COPY
02	02		ACE	CONTROL COPY
03	03	M/s NPCIL QA	HEAD-QA	CONTROL COPY
04	04	M/s NPCIL FE	HEAD-FE	CONTROL COPY
M/s BHEL				
05	05	M/s BHEL	SITE IN-CHARGE	CONTROL COPY
06	06	M/s BHEL QA	HEAD-QA	CONTROL COPY
07	07	M/s BHEL STORE	STORE IN-CHARGE	CONTROL COPY
08	08	M/s BHEL PLANNING	HEAD-PLANNING	CONTROL COPY
09	09	M/s BHEL DOCUMENTATION	DOCUMENT CONTROLLER	MASTER COPY

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

Revision Status

Rev. No.	Date of 1st Issue/Rev.	Description
00	17.05.2022	First submission.
00	25.06.2022	Resubmission incorporating NPCIL comments dt.10.06.2022
00	07.07.2022	Resubmission incorporating NPCIL comments

BLANK PAGE

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

CONTENTS

1. SCOPE:

This Procedure describes the steps to be followed during receipt of materials at NPCIL stores, handling, transportation, cleaning, fabrication, erection, alignment, welding and testing of SS Piping and O-let mounting involved in Secondary Cycle System for KKNPP Unit --3 & 4. Applicable systems are mentioned in Annexure-III. Torque tightening of bolts is excluded from the scope of this procedure.

2. PURPOSE:

Purpose of this procedure is to describe the sequence of work to be followed during receipt of materials at NPCIL stores, handling, transportation, fabrication, erection, alignment, welding and testing of SS Piping systems as per approved drawings, specifications and guidelines.

3. APPLICABILITY:

This Procedure is applicable for the receipt of materials at NPCIL stores, handling, transportation, fabrication, erection, alignment, welding and testing of SS Piping systems inSecondary Cycle System of TSS Package, KKNPP Unit – 3 & 4. WDs applicable are mentioned in Annexure III.

4. REFERENCE DOCUMENTS:

i. As per Tender (NPCIL/KK/-3&4/CONST/MECH/PT/2018/56), Technical specification – Section V
ii. PNAEG-7-003-87-Certification of rules for welders of Nuclear Power Plant Equipment and Pipelines
iii. PNAEG-7-008-89- Safe operation in equipment's and Pipelines
iv. PNAEG-7-009-89- Welding and Weld Surfacing of equipment's and applications
v. PNAEG-7-010-89- Welding joint and weld surfacing of Inspection regulations
vi. SNIP 3.05.05-84- Technological Equipment and Pipelines
vii. Procedure for Incoming Material Storage and Inspection - I46/KK34/0/0/QA/QFS/WD005
viii. Procedure for Visual Inspection - I46/KK34/0/0/QA/QFS/WD004
ix. Procedure for De-preservation - I46/KK34/0/0/QA/QFS/WD006
x. Procedure for Radiographic Testing - I46/KK34/0/0/QA/QFS/WD007
xi. Procedure for Ultrasonic Testing - I46/KK34/0/0/QA/QFS/WD016
xii. Procedure for Dye Penetrant Test - I46/KK34/0/0/QA/QFS/WD003
xiii. Procedure for Welder Performance Certification Testing - I46/KK34/0/0/QA/QFS/WD001
xiv. Work procedure for Technology certification of welding procedure specification - I46/KK34/0/0/QA/WPR/WD001
xv. Procedure for Electrode Storage, Verification, Issue and Control - I46/KK34/0/0/CC/WPR/WD006
xvi. Work procedure for Foreign Material Exclusion - I46.KK34.0.0.CC.WPR.WD005
xvii. QP for SS piping - I46/KK34/0/0/QA/QP/WD039
xviii. Introduction of Designing of Technological Steel Pipe-Lines with Pnomupto 10 Mpa - SN-527-80
xix. Rules for checking quality of welded joints of Nuclear Power Plant pipelines - RD 34-10.030-89

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

5. RESPONSIBILITY:

The responsibility for implementation of this procedure lies with BHEL/PSSR site in charge-Kudankulam.

Sl no	Description	Responsible person
1	Materials receipt	BHEL-Erection HOS
2	Piping Fit-up, Erection and Welding	BHEL-Erection HOS
3	Co-ordination with NPCIL for QP control point clearance,Inspection & Testing	BHEL-QC HOS

6. PRE-REQUISITES:

1. Availability of NPCIL clearance for erection of pipelines.
2. Availability of erection scheme and schedule.
3. Availability of required working drawings, DCNs, TARs for erection.
4. Availability of material.
5. Availability of pipe pedestals, EPs, structural members for erection of supports
6. Availability of all tools and tackles with valid test certificates
7. Availability of valid calibration certificates for all measuring instruments.
8. Availability of handing over protocol for pipe pedestals from NPCIL,civil for co-ordinate and level of EPs
9. Availability of control point co-ordinates
10. Ensuring thatblocks are supplied as per WD requirement.
11. Availability of PPEs for workmen and staffs.
12. Availability of approved JHA.
13. Availability of approved Construction Safety Work Permit
14. Compliance of JHA and daily work permit for the work.
15. Availability of approved work procedure & QP
16. Availability of approved WPS
17. Availability of qualified welders
18. Availability of fitters, riggers, helpers, grinders
19. Availability of wooden sleepers, temporary structural materials

20. Briefing of job to workmen before start of work on daily basis
21. Ensure good housekeeping
22. Availability of power supply
23. Availability of temporary storage area for T&Ps, welding machines, scraps.
24. Argon gas for shielding & purging.
25. Work areas: House keeping to be carried out regularly. Ensure cleaning of loose materials, scrap, tools in the working areas.
26. Scrap collection: All scraps (including wooden scrap) shall be collected and kept well away from any gas cutting or welding operations till they are removed from their respective area.
27. Lighting: The whole working area should be illuminated. Min 100 lux shall be maintained

7. PLANT & MACHINERIES:

The following tools will be used for assembly, erection, alignment & Inspection purposes

7.1 Machineries, Tools and tackles:

a) Hydraulic jacks (5 Ton/2 Ton) – 1no.
b) Pallet jack,2T - 2no.
c) Dumpy level – 1no.
d) SS / Brass hammer – 1no.
e) PP Belt – 1no.
f) Web sling/wire rope slings – 6nos.
g) Welding Generator /Tyristor controlled rectifiers , 400A – 6nos.
h) TIG welding torch – 4nos.
i) Welding consumables like argon gas, electrodes
j) Gas cutting set – 1no.
k) Acetylene cylinders/LPG cylinders and Oxygen Cylinders – 2set.
l) Master electrode baking oven 500^{0}C – 1nos.
m) Portable electrode holding oven 150^{0}C – 6nos.
n) Hydra 14-20MT, trailer – 20ft/40ft
o) Cutting machine – 2nos, Grinding machine – 4nos.
p) Ladder-1no., Torch light-2nos.
q) Chain Pulley block, 2T/3T – 4nos, 5T – 3nos.
r) D-shackles – 10nos.
s) Spanner set – 1no
t) Skid roller – 1set
u) Manual torque wrench, ratchet type – 1no.
v) Bevelling machine – 1no.
w) Engraving machine – 1no.
x) Boroscope – 1no.
y) Ferrite meter

7.2Measuring devices:

a) Water level.
b) Sprit level.
c) Plumb bob.
d) Steel Rule (1ft., &2ft.)
e) Measuring tapes (3,5,15 metres)
f) Steel tape 50 M ,15 M,5 M.
g) Plumb bob
h) Weld gauge, Try square, Vernier caliper, feeler gauge.
i) Bevel protractor

8. SEQUENCE OF ACTIVITIES:

a) Preparation of Work procedure.
b) Preparation of QP.
c) Welding procedure qualification.
d) Welder qualification.
e) Issue of materials and preparation of IMIR.
f) Shifting of materials to erection area
g) Testing of valves
h) Cleaning of pipelines.
i) Joint codification
j) Pre assembly of piping.
k) Marking of pipeline axes
l) Positioning of piping
m) Fit up
n) Welding.
o) NDT.
p) Erection of permanent supports.
q) Locking of spring supports before hydraulic testing.
r) FME inspection.
s) Hydraulic testing.
t) Flushing of pipe lines.
u) Floating of pipe lines.
v) Re-preservation.
w) CRR.

9. MATERIAL CONTROL AND INCOMING MATERIAL INSPECTION:

a) Material requisition form has to be filled with details of package numbers, SSIR, quantities.

b) Raise CIV based on material requisition form and material to be received from storage area/shed of NPCIL
c) Material on receipt from NPCIL shall be checked to meet incoming inspection requirement as per approved procedure I46-KK34-0-0-QA-QFS-WD005.
d) The following checks are to carried out before taking the materials for erection and report to M/s NPCIL for any deviation
   i) KKS, block nos, line numbers on the pipes and fittings
   ii) Tag numbers of valves
   iii) diameter and length of pipes
   iv) Availability of attachments like nozzle, support plates as per drawing
e) Check for completeness of shipment with reference to item details of supports, block details of piping with reference to the WDs and SSIR details. Deficiency, if any shall be brought to the notice of ENC/NPCIL.
f) Material shall be kept over wooden sleepers/concrete sleepers/structural members with SS strips/Teflon sheet.
g) Precaution to be taken to avoid entry of water, foreign materials inside pipes and fittings
h) Precaution to be taken while storing SS materials. SS material shall not be in contact with CS materials.
i) Fabrication of SS pipes shall be in separate location/shed.
j) Gas cutting material/CS welding spatter should not be allowed to fall on SS pipe materials. Suitable arrangements like fire blanket shall be used.
k) Dust contamination shall be controlled in the SS working area.
l) System pipelines along with their respective supports shall be received from NPCIL stores (Support material will be supplied in loose condition such as body of support, support clamp, clamp fasteners, shim plates, guide plates, hanger rods, spring assembly, supporting structure).
m) All the received components shall be segregated support wise and identification marking shall be made by tagging. Once identified and marked, care shall be taken not to interchange the items.
n) While taking motorized valves from NPCIL stores, ensure that the power supply units /connection sockets coming along with valves are not drawn from stores.
o) If any power supply units are coming along with actuator, the same has to be handed over to NPCIL writing KKS code of the element.
p) Ensure preservation and proper storage of issued material at BHEL stores and at site shall be as per procedure I46-KK34-0-0-QA-QFS-WD006-R01
q) .
r) Don't store SS with other metals (storage platform, scaffolding, tools)
s) Don't fix SS with fixings of dissimilar materials (galvanized nuts, brackets)
t) Don't attach SS materials with other metals directly (pipelines)
u) Don't clean SS with CS brushes.
v) Don't use grinding discs containing iron
w) Separate SS from other materials with synthetic gaskets, washers, sleeves.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

10. FABRICATION:

10.1 Preliminary Activities:

1. Ensure the completion of supply of material for the portion of erection planned.
2. Identification of the joints to be carried out in pre-fabrication at BHEL stores. (Possible in case of small bore piping).
3. Required spools are identified with spool number / block numbers from BHEL stockyard and shifted for fabrication.
4. Grinding wheels, files, chipping tools, wire brush shall be specifically identified for SS welding activity.

10.2 Marking and Cutting:

1. Proper de-preservation shall be carried out on the joint portion, prior to start of the job using acetone / cleaner /white sprit as mentioned in working document.
2. Each spool of pipe, regardless of length, and each of the other components, shall be clearly identified by legible marking on the part.
3. The marking shall have the applicable specification number grade.
4. When a part is to be cut, the identification mark including KKS code shall be transferred to all spools.
5. SS Pipes cutting shall be done with the help of plasma cutting or grinding machine keeping suitable cutting allowances, 5-10mm.
6. Only SS grade grinding wheels to be used.

10.3 Edge Preparation:

1. All joints shall have edges prepared preferably by machining / grinding as per relevant working documents. WDs shall be referred for Edge preparation or else PNAE G-7-009-89.
2. Pipe spools with edge prepared shall be handled carefully to avoid the damage of edge profile.
3. The ends to be welded shall be properly cleaned to remove paint, oil, grease, rust, dust and other foreign material.
4. After edge preparation, profile and dimension of weld edges shall be checked using bevel protector / templates.
5. Cleaned pipe end shall be covered with plastic end caps at shop as well as at site.
6. Any big bore pipe spool which are supplied without edge preparation, weld edge for such spools shall be prepared as per the requirements given in the working drawing /applicable standards / technical specification.
7. Some of the hook up joints in the big bore pipe spools, weld edge preparation is needed to be carried out in-situ to suit the site condition. Pipe fittings such as throttling orifice, flow restricting orifice and other components in big bore will be installed after successful flushing operation. After flushing these elements are to be installed by cutting of the main line and edge preparation at site.

8. Cutting and edge preparation of pipe spools shall be carried out by using bevelling machine/grinding machine.
9. For safe reach and carrying out proper bevelling operation for pipe lines appropriate scaffolding arrangements shall be provided.
10. Only qualified and experienced operator shall be engaged for operating the bevelling machine.
11. In case of connection welding with equipment or other edge prepared components, the ID of the existing pipe shall be verified before taking up edge preparation. Some case ID pipe shall be machined / bored to required length in order to match the diameter as mentioned in the standard.

10.4 Alignment and Fit-Up:

1. ID mismatch of joints shall be checked during fit-up.
2. Before fit up of the weld joint, the profile and dimensions of the weld end preparation should be checked. If the specified tolerances are not achieved, this shall be corrected by grinding / machining.
3. All weld joints fit up shall comply with the tolerances specified in the drawings
4. Identification of spools shall be as per assembly drawings & WDs.
5. Field & shop joints identified in drawing shall be transferred prior to start of fit-up.
6. Fixing of removable type / water soluble dam to be properly ensured. (Refer Sketch – Ifor removable type dam)
7. No masking tape shall be used for fixing soluble dams.
8. The members to be welded shall be fitted, aligned and retained in position by cleats, tack weld or clamps.
9. A qualified welder shall carry out the tack welding.
10. Minimum three numbers of tacks are required to hold the joint at the correct setting, keeping the tack length at least 1" long around the job at uniform distance between tack welds.
11. All the welding process tack welds shall be either removed completely or shall be properly prepared by grinding or filling their stopping and starting ends.
12. All the tack welds shall be examined visually for defects and if found defective, it shall be completely removed. Tack weld shall be examined by PT.
13. Root gap, bevel angle, root face shall be as specified in the working document.

10.4.1 Precautions during fit-up:

1. All machined surfaces shall be protected from dust and mechanical damages.
2. All the thread connection shall be either capped or have thread plugs till the equipment has been installed.
3. Utmost care shall be taken while carrying out fit-up of piping connection with equipment nozzle, heat exchanger so that no welds spatter falls inside the equipment.
4. The areas from which temporary attachments have been removed shall be dressed smooth and shall be examined by PT.

10.5 Foreign Material Exclusion (FME):

1. During execution of piping works utmost care shall be ensured to prevent foreign material inside these items. Procedure for FME,I46-KK34-0-0-CC-WPR-WD005 shall be followed.
2. In regular intervals all workers shall be trained to prevent stacking / placing of hand tools, welding consumables, PPEs inside pipeline during erection and welding.
3. All dams shall have identification number and authorization signature by QC (BHEL). Record shall be maintained for dam placement and removal (Dam register).
4. Dam register shall be maintained by BHEL and checked by NPCIL for all the dams such as soluble dams, rubber dams. It shall be ensured whether all the dams are properly removed to prevent the foreign material inclusion in the pipe lines, equipment. The Dam registers shall be frequently reviewed by NPCIL.
5. Periodical verification of dams shall be conducted by BHEL Execution and QC.
6. Damaged dams shall be disposed properly and shall be recorded.
7. Latest tools such as inflatable dams for pipe welding shall be considered in place of conventional dams if necessary.
8. Boroscope shall be used to carrying out inspection inside pipe on regular intervals during execution to prevent the foreign material inclusion.
9. The video Boroscope shall be used wherever pipe changes its direction, whenever valve erection is being done, whenever piping is terminating with equipment and wherever required in special conditions to prevent the foreign material inclusion.
10. In case any foreign material is found in the Pipe system(s), appropriate measures shall be taken as per the Procedure: I46-KK34-0-0-CC-WPR-WD005 (Foreign Material Exclusion). Any action to retrieve / dislodge the foreign material shall be taken after due deliberation with NPCIL and only with NPCIL's concurrence.

10.6 Shielding and Purging:

1. Argon gas shall be used for purging. The requirement/purity of the same shall be as Grade 3 as per IS 5760-1998 or first grade of GOST:10157-79 (99.987%).
2. Purging a piping system is a two stage operation. During the first stage the purge gas is used to remove air inside the piping prior to welding.
3. During the second stage, when root pass welding is performed the purge flow rate is reduced so that the purge maintains a slight positive pressure on the inside of the pipe,
4. This eliminates air-entry into the pipe and prevents oxidation of the root surface.

10.6.1 Purging flow rate:

1. Purging at flow rate should be 6 times the volume, based on the diameter of pipe such that the volume of the section of piping between the dams can be completely replaced.
2. In no case should the initial purge be for less than 10 minutes. (Table of initial purging time for various diameters are attached in ANNEXURE-II)
3. For TIG welding, purging shall be maintained during welding of root pass and subsequent hot pass.

4. Generally purging is carried out using removable dams or soluble dams.

10.6.2 Removable dams:

1. A typical arrangement of removable dam is shown in SKETCH-I.
2. Distance of dams shall be minimum 150 mm from joint centre and minimum distance between dams shall be 300 mm.
3. All the dams shall be fully identified and accounted to eliminate the possibility of leaving them in the system.
4. The dams used in purging shall be placed in such a position that they can be removed intact.
5. Dam material shall be compatible enough to withstand welding temperature developed.
6. Purging arrangement shall not be removed till the completion of NDT of the welded joint.
7. Care shall be taken to avoid melting/ burning of dams inside pipe.

10.6.3 Soluble dams:

1. Soluble dam shall be used only in unavoidable situations.
2. While using soluble dam, total leachable chloride content in the paper used shall be less than 25ppm or within acceptable limit.
3. No masking tape shall be used for fixing soluble dam paper. The same shall be recorded in dam register.

11 WELDING

1. All welding procedures shall be qualified.
2. Welder qualification shall be as per approved procedure I46-KK34-0-0-QAP-QFS-WD001
3. Joint identification code and joint numbers have to be given for each piping system as per the approved procedure I46-KK34-0-0-CC-WPR-WD021. The joint numbers should be given along the flow direction. The joint numbering has to be incorporated into as per isometric drawing for easy identification and reference.
4. Joint codification shall be carried out as per theapproved procedure I46-KK34-0-0-CC-WPR-WD021.
5. Electrodes /filler wires that are accompanying piping only to be used. In case of using from other brand electrodes /filler wire, ENC/NPCIL approval shall be taken.
6. MTC for welding & NDT consumables supplied by M/S BHEL shall be available prior to usage and incoming inspection shall be completed.
7. No welding shall be done on surface, which are wet or exposed to rain.
8. Haphazard striking of electrode on the base metal in establishing the arc shall not be permitted.
9. Starting of arc in GTAW welding shall be done from high frequency attachment to avoid damage to the parent metal.
10. Sequence of application of beads / layers, category and profile of joints shall be ensured.
11. Peening shall not be allowed.
12. Starting of arc in GTAW welding shall be done from high frequency unit to avoid damage to the parent metal / to eliminate tungsten inclusion from non-consumable electrode.

13. Carbon Steel wire brush, shims, cleats, grinding wheels shall not be used.
14. Welds shall be cleaned between passes to remove all traces of slag and flux before successive beads or layers are deposited.
15. Interpass temperature shall be maintained as per WPS.
16. During GTAW welding purging shall be provided for root pass and one or two hot passes adding to a thickness of 4.5mm.
17. Vertical welds shall be done in upward direction.
18. Whenever possible two welders shall be used simultaneously during welding pipe with diameter more than 300 mm.
19. Window shall be provided to inspect root welding from welding-side wherever required.

11.1 Consumable Control:

a) The electrodes / filler wire shall be as specified in the working document.
b) Only NPCIL approved brands of electrode and filler wires shall be used.
c) Welding consumable and electrodes shall be controlled and recorded in the register.
d) Baking register with details of electrode batch certificate, in time, out time, quantity to be maintained
e) Reconciliation of the electrodes to be carried out every day

11.2 Welding Technique:

11.2.1 Starting the Arc:

1. High frequency starting units shall be employed for GTAW process during SS pipe welding.
2. Before striking an arc on a previously deposited bead using the SMAW process, the first deposit should be cleaned of any slag present by use of chipping hammer and SS wire brush.
3. If the previous bead has a convex face, it is particularly important to remove particles of slag from the hollows along the edges of the bead. Starting points can be ground.
4. If required for this purpose, filling of arc crater shall be done before the arc is removed from the root pass.

11.2.2 Operating position and Arc manipulation:

1. Welding shall be carried out in the flat position wherever possible, because it is faster and easier.
2. Arc manipulation shall ensure full penetration, full fusion, uniformity of bead surface and floating of slag, oxide gases.
3. Covered electrode shall be tilted in the direction of welding (forehand). In general, the inclination is 45°.
4. Short arc length shall be employed to minimize oxidation of elements such as chromium, silicon, manganese and columbium and to improve corrosion resistance and mechanical properties of weld metal.
5. Weaving of the electrode during welding should be carefully controlled.
6. Stringer bead technique shall be used with a slight oscillation if necessary to avoid entrapped slag.

7. A slight transverse oscillation shall be employed to avoid entrapped slag along the groove and to minimize the number of beads needed to fill a joint. If the weaving motion is excessive, the molten pool may not be adequately protected by the shielding medium at all times.
8. In SMAW process, the weave width shall not exceed three times the electrode diameter.
9. Haphazard striking of the electrode on the base metal in establishing the arc shall not be permitted. If required starting plate can be used (same material). Arc strike shall be removed by grinding and checked by LPT for defects.

11.3 Weld size and contour:

1. A wide bead with a concave face shall not be generally employed for welding.
2. This shape will have a greater tendency to produce longitudinal hot cracking in the centre of the bead compared to a stringer bead with a flat or convex face.
3. Heavy weld reinforcement of a butt joint or a sharp change in section thickness between weld and base metals shall be avoided in order to minimize the stress concentration at the toe of the weld.
4. Since the strength of the weld metal is exceeding that of the base metal, the reinforcement shall be maintained to a minimum.
5. Overlap or undercut shall not be present.

11.4 Welding current and travel speed:

a) Relevant standard and manufacturer recommendation shall be followed for current range and travel speed.
b) GTAW electrode shape at tip shall be pointed for DC welding and spherical for A/C welding.
c) Welding torch shall be slightly inclined in the forehand welding position.
d) If tungsten contamination occurs during welding. Arc shall be eliminated and defect shall be grinded out.
e) Electrode extension (beyond gas cup) shall be kept as short as possible.
f) GTAW process shall be used with DCEN polarity.
g) SMAW process shall be used with DCEP polarity.
h) Weld Technique (process) shall be monitored and controlled by controlling above variables.

11.5 Weld Visual:

a) The root pass shall be visually examined and shall be free from defects such as pores, crack.
b) The final pass of welding shall be inspected for completeness, reinforcement, overlaps, pinholes, undercuts, cracks and it shall be made free of defects.
c) Acceptance criteria for weld visual shall be as per RF codes.
d) All welded joints shall be adequately punched/engraved, on the outer side of welded joints at a distance of 30 to 50 mm from the weld reinforcement edge. The size of metal stamp shall be 6 to 12 mm. The depth the punch shall be 1mm. Punching details shall contain joint no, Line no and welder ID.
e) Separate register shall be maintained for joint no, Line no, welder ID who is welding the joint.

11.6 Electrode storage and moisture control

f) Electrode storage and Moisture control is as per approved procedure I46-KK 34/O/O/WPR/WD006.

12 ERECTION OF PIPING:

12.1 Cleaning of pipeline:

a) The pipeline, valves should be cleaned manually or with compressed air before erection so that foreign particles are removed.
b) Approved work procedure for FME-BHEL-KKNPP3&4/TSS/WP/014 (I46-KK34-0-0/CC/WPR/WD005) shall be followed.

12.2 Piping Pre assembly

a) To reduce the quantum of work at higher elevations, pre-assembly may be done at floor level before erection to final location of pipes/fittings.
b) Line numbers and block numbers to be checked with reference to the applicable WDs
c) Dimensions – length of individual blocks and the total length after assembly shall be checked.
d) Orientation of nozzles (if applicable) – orientation (degree/inclination) shall be such that after erection to final positions , degree/inclination shall be in line with that shown in WD
e) The root gap to be checked and recorded. Refer clause 18.0
f) Root mismatch shall be checked and recorded. Refer clause 18.0

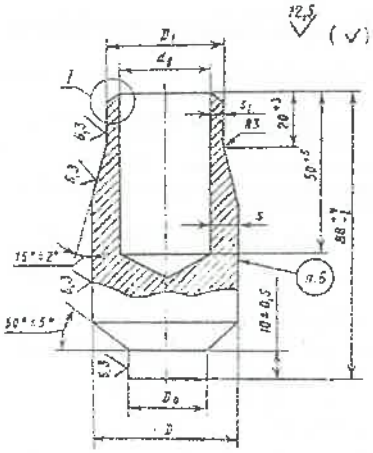
12.3 Piping Erection:

1) Pipes have to be carefully handled and shifted from painting shop to erection area. PP belts shall be used to avoid damage of pipe and its paint.
2) Rollers/trolley/pipes shall be used to lead the pipes inside building.
3) These pipes are to be lowered based on the area of work front available. The KKS & block numbers shall be identified accordingly
4) Check the correctness of pedestals and EPs with reference to the civil handing over protocols and WDs. Deviation of more than 30mm shall be reported to ENC/NPCIL.
5) Pipes are to be placed over temporary supports.
6) During fit-up, joints are aligned using hydraulic jacks or with chain pulley blocks at both ends of the pipe with wooden sleepers/ structural materials for packing.
7) Root gap and root mismatch shall be within the acceptance criteria mentioned under clause 17.0
8) Positioning of pipelines, supports, and valves shall be maintained as per the drawing with a tolerance of 50mm.
9) Nozzle orientation shall be checked as per drawing.

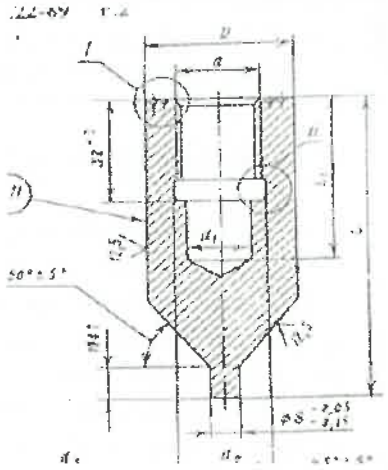
10) Permanent supports to be erected. Incase of non availability of permanent supports, temporary supports may be erected.
11) Ensure all the supports are installed as indicated in the drawing.
12) Plates/shims shall be provided to make up the gap, if any, between support pedestals and supports (applicable only for supports resting on pedestals)
13) Slope shall be maintained as per the drawing towards the drain points.
14) After fit up and alignment, the joint shall be cleared for welding. Qualified welder shall carry out welding as per approved QP and WPS.
15) After welding, NDT shall be carried out as per Annexure-IV
16) Hydro test shall be conducted for entire circuit as approved by NPCIL. After satisfactory completion of hydro test, final hook up joint with the related equipment shall be completed. NDT for those joints not covered in HT shall be carried out as per the recommendation of ENC/NPCIL.
17) Final joints with rotary equipment shall be carried out after completion of floating.
18) Check the gap available for thermal expansion and insulation from nearby structure. Report to ENC/NPCIL in case of issue.
19) While erecting valves on pipelines, ensure the following.
    i) The tag number of valves, nominal bore, valve grade, direction of flow is to be checked
    ii) Valve test report to be verified before erection of valves in position.
20) Ensure valves do not foul with existing platforms / or with other pipe lines during their operation and maintenance.

12.4 Mounting of O-let / Thermo-Well Lug in pipe lines:

Branch pipe connections for vent, drain and I&C of process piping / tubing from the main pipe will be made using weld O-lets. These O-lets will be supplied in loose condition and are to be mounted on the supplied pipe spool / fabricated pipe spool. Material of construction of these O-lets shall be of stainless steel.

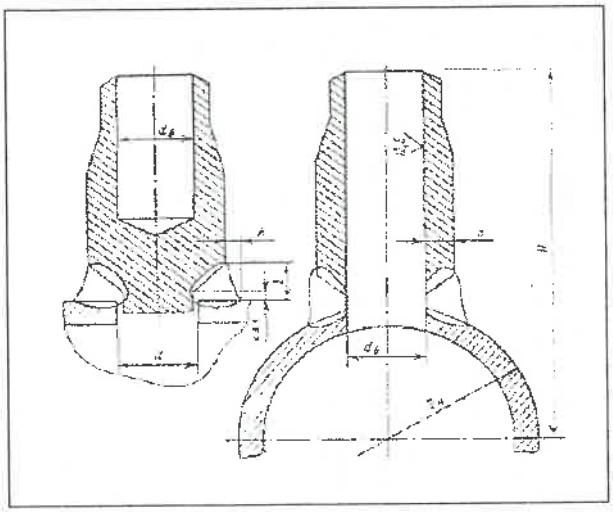


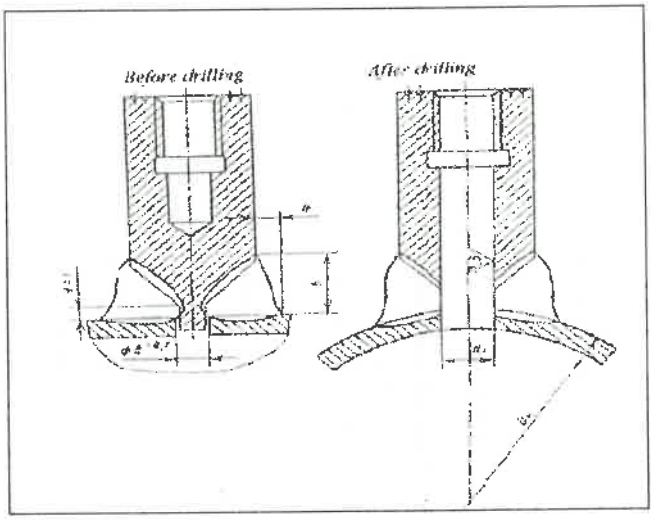
Typical construction of O-lets with dimensions.



Typical construction of Thermo-well lugs with dimensions.

1. As shown in the above sketches, O-let / Thermo-well lugs are machined components made of forged material. These are machined for final external dimensions.
2. Erection, welding, drilling and inspection of O-lets / thermos-well lugs shall be taken up on the pipe blocks in the fabrication facility only before shifting of pipe blocks to site. However, care shall be taken to prevent damage to welded O-let connection.
3. ID of both O-let / Thermo-well lugs will be in solid condition, ID shall be drilled through to the final dimension after welding of O let to the pipe block.
4. O-let / Thermo-well lugs are need to be mounted on both small bore and big bore pipelines.
5. Marking shall be carried out for position and orientation of the O-let. The same shall be offered to NPCIL for checking the correctness before proceeding for drilling pilot hole and pilot hole shall be drilled as per the marking to required diameter as per the configuration of the O-let.
6. Drilling may be done using a pedestal drilling machine or radial drilling machine or pipe mounted drilling machine based on the size and configuration of the pipe block and based on the available provision at location.
7. During mounting of drilling machines (in case of pipe mounted drilling machine) packing material shall be used to prevent direct contact of carbon steel with the stainless steel pipes.
8. O-let / Thermo-well lugs shall be mounted in the pilot hole. Fit up shall be made as per the requirements provided in the drawings and the relevant standards.
9. Once fit up is completed, O-let / Thermo-well lugs shall be released for welding as per the welding procedure.
10. Welding of O-let / Thermo-well lugs with the pipe spools shall be carried out using GTAW /SMAW as per the drawing.
11. On completion of welding of O-let / thermos-well lug with the pipe spool, carryout inspection and other NDEs and clearance for final drilling shall be obtained as per requirements of WD.
12. Final hole dimensions shall match with the size of the connecting pipe. As mentioned above final drilling can be carried out using pedestal drilling machine/ radial drilling machine or pipe mount drilling machine based on the configuration of the pipe blocks.
13. Utmost care shall be taken while setting of machine for final drill in O-let / Thermo-well lugs. Error in machine setting will lead to eccentric hole and non-uniform thickness, damage to internal threads of the thermos-well lugs.
14. While carrying out drilling on pipe block which is already erected in position, chips shall be removed out, in order to minimize the foreign material entry into the pipe line.
15. Post drilling cleaning shall be carried out to remove chips, oil, grease and any kind of foreign material, a thorough inspection shall be carried out after cleaning of the pipe block.
16. Inspection shall be carried out using video Boroscope for the O-let / Thermo-well lugs from inside the pipe spool wherever it is inaccessible.
17. Schematic diagram of the O-let / Thermo-well lugs in fit up after welding and final drilling is as shown below.





18. Mounting of o-lets and thermo well lugs to be erected and welded as per the NPCIL approved work procedure I46-KK34-0-0-QA-QFS-WD009.

12.5 Tightening of Bolts:

I. All bolts shall be engaged so that there is visible evidence of complete threading through the unit or thread attachment at least two threads shall be projected beyond unit.

II. In bolting of gasket flanged joints 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.

III. Torque value will be incorporated in the procedure after obtaining the values from M/s NPCIL. Hence torque tightening is excluded from the scope of this procedure.

12.6 Floating of piping

a) Piping systems have to be floated after completion of permanent supports, drains and vents. After completion of all welding, the pipelines have to be connected with critical equipment like turbine and feed pump etc.
b) The load of the piping system has to be taken on hangers after releasing the locking.
c) The springs have to be adjusted by tightening/loosening the turn buckles.
d) The restrain supports of the piping also may require adjustment.
e) The joints with equipment should freely match, without any significant load.
f) Once the free joint is obtained and the joint fit up is done, the springs may be locked and the joint is to be welded in arrested position.

13 NDT:

a) NDT as applicable and mentioned in the WD's shall be performed as per the approved drawings and procedures.
b) Quantum of checks for different NDT methods are brought out in Annexure-IV.
c) Random inspection of circular weld joints shall be as per CL.9.1.5, 9.1.6 of PNAE-G-07-10-89.
d) Visual and Measuring examination as per approved work procedure - I46-KK34-0-0-QA-QFS-WD004.
e) Dye Penetrant Test as per approved work procedure – I46-KK34-0-0-QA-QFS-WD003.
f) RT as per approved work procedure-I46-KK34-0-0-QA-QFS-WD007.
g) UT as per approved work procedure-I46-KK34-0-0-QA-QFS-WD016.
h) All the weld joints of parts from steels of austenitic class made with niobium containing filler materials shall be covered with 100% PT.
i) The content of ferrite phase should be determined in the weld with austenitic filler material. The content of ferrite phase in the coated metal should be within 2-8% in the welded joint of structures (temperature up to 350 deg.)

14 REPAIR OF WELDS:

Defects found during any of the NDT methods shall be repaired as below:

a) The surface defects should be corrected mechanically with provision for continuous transition in the areas of the grooves by abrasive tools, cutting or chipping with subsequent grinding.
b) Defects in root shall be removed by grinding and welding shall be carried out from outside of the pipe.
c) In case of slag inclusion, slow grinding will be done till complete removal of slag. Visual / RT inspection shall be carried out to ensure complete removal of slag as per standards.
d) The Re-welded area shall be re-examined by the methods specified for original welds.
e) Where radiography is required, a minimum amount of 50mm-film overlap beyond the repair edges shall be ensured.
f) Maximum times of repairs permitted is 2 times. Repair means when weld is gouged & re-welded.
g) Additional inspection for defective joints shall be as per Cl.9.1.9 (If any defects are discovered during random inspection by any method, additional inspection shall be carried out by same method in doubled scope. If there is defect in additional inspection, 100% inspection to be carried out in entire group.

15 PIPE SUPPORTS:

(a) While erecting the pipeline hangers/supports, the location of the hangers/supports is to be ensured.
(a).1 – location of supports shall be checked from the terminal point to the nearest supports or from center of bend to the nearest support.
(b).2- Location of subsequent supports will be checked with reference to the location of supports with reference to (a).1

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

(c).3 – Tolerance of 100mm shall be allowed for the location of supports.

(b) The hanger/support tag number is to be identified with reference to the drawings of the system.

(c) Elevation shall be checked. Minor deviation in elevation upto 50mm shall be allowed to maintain the slope, if required.

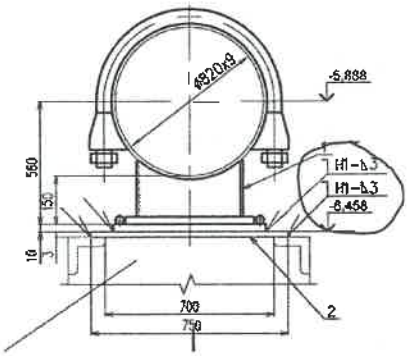
(d) Before erecting the spring cages /Constant Load Hanger, the cold compression value as per design to be ensured with respect to the drawing/document. The hanger should be erected with the spring in locked condition at the cold value. These are to be released only during floating or after completion of hydraulic test and the system is released for commissioning. Refer Annexure V for the list of supports

(e) While erecting the suspension arrangement, it is to be ensured that inclination of the suspension is to be maintained as per working document. Inclination will be checked with plumb bob and tape.

(f) While erecting the hanger components, the following details are to be ensured.

1. Welding detail of hanger and supporting structures shall be as shown in the WD. Typical example shown in table 1.
2. Maintain gap of 15-30mm in the turn buckle for tightening of hangers.

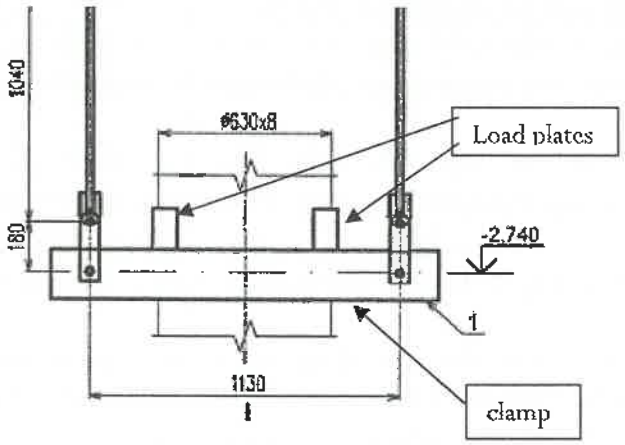
Table 1



(g) While fixing clamps on vertical lines, ensure the load plates are welded on the pipe such that the pipe loads are transmitted directly to the clamps. The clamp shall be loaded on all the load plates. Refer table 2

Table 2

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22



(h) On releasing the hanger locks during floating, the cold set values of adjacent hangers may get disturbed. This has to be corrected by process of reiteration till the correct setting value is achieved in all the hangers. Refer Annexure-V for the list of spring hangers and applicable cold set values.

(i) While setting the hanger for cold /hot values it should be ensured that the design values are obtained as per WD. For any deviations of beyond +/-10mm, designer approval is to be taken.

(j) For restraints /guides/anchors, the gaps shall be uniformly maintained.

(k) During Hydro test, the springs of supports should not be loaded.

(l) When the unit is running on full parameters the hot value of the spring supports has to be recorded.

(m) After completion of piping erection including supports, the deviations from the drawing if any, are to be incorporated in the as built drawing.

(n) After completing hydro test and normalization, springs are to be released. The spring values shall be recorded and to be compared with the design values. Deviation beyond +/-10mm shall be reported to designer for concurrence.

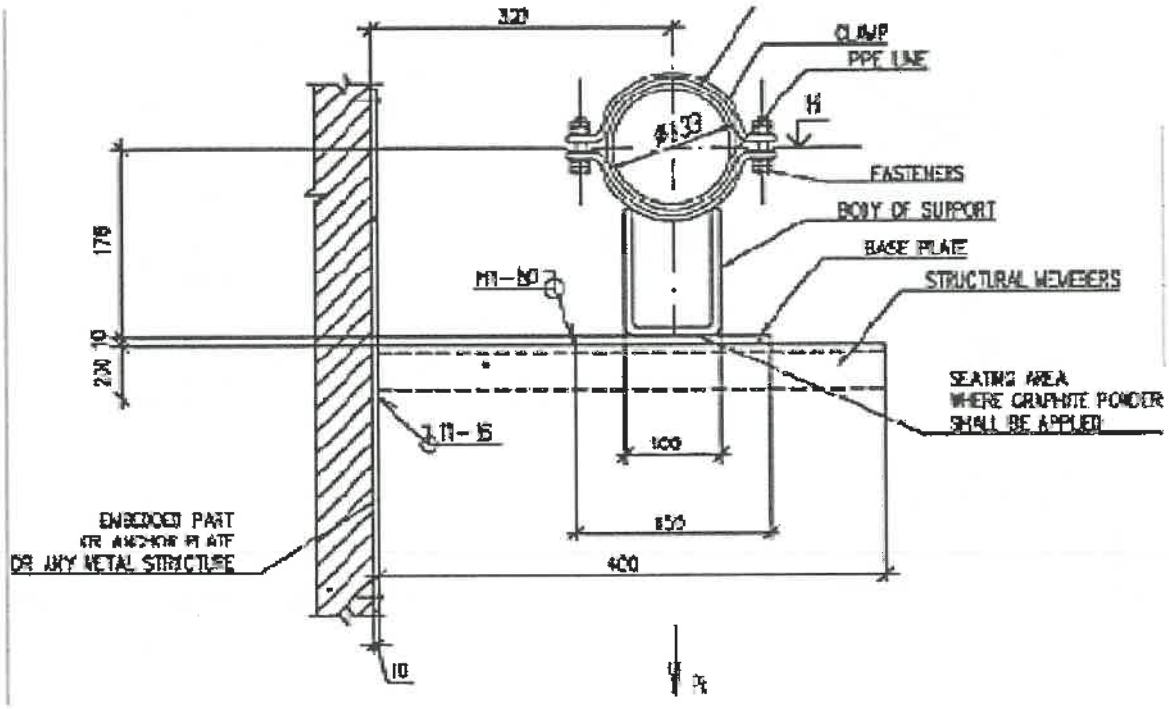
(o) There shall be an additional check to ensure thermal compensation by re checking of first support from the main branch, if the size of the pipe from the branch is 80Nb and below.

15.1 SPECIFIC GUIDELINES FOR DIFFERENT TYPES OF SUPPORTS:

15.1.1 SIMPLE SLIDING SUPPORT:

1. Simple sliding supports are dead-weight supports i.e. they simply rest on the support structure. They consist of shim, clamp, fasteners, body of support, base plate and structural members (refer the image below) –
2. The body of support, designated by with Russian standards, shall be carefully selected to avoid mismatch.
3. Body of support shall rest on the base plate.

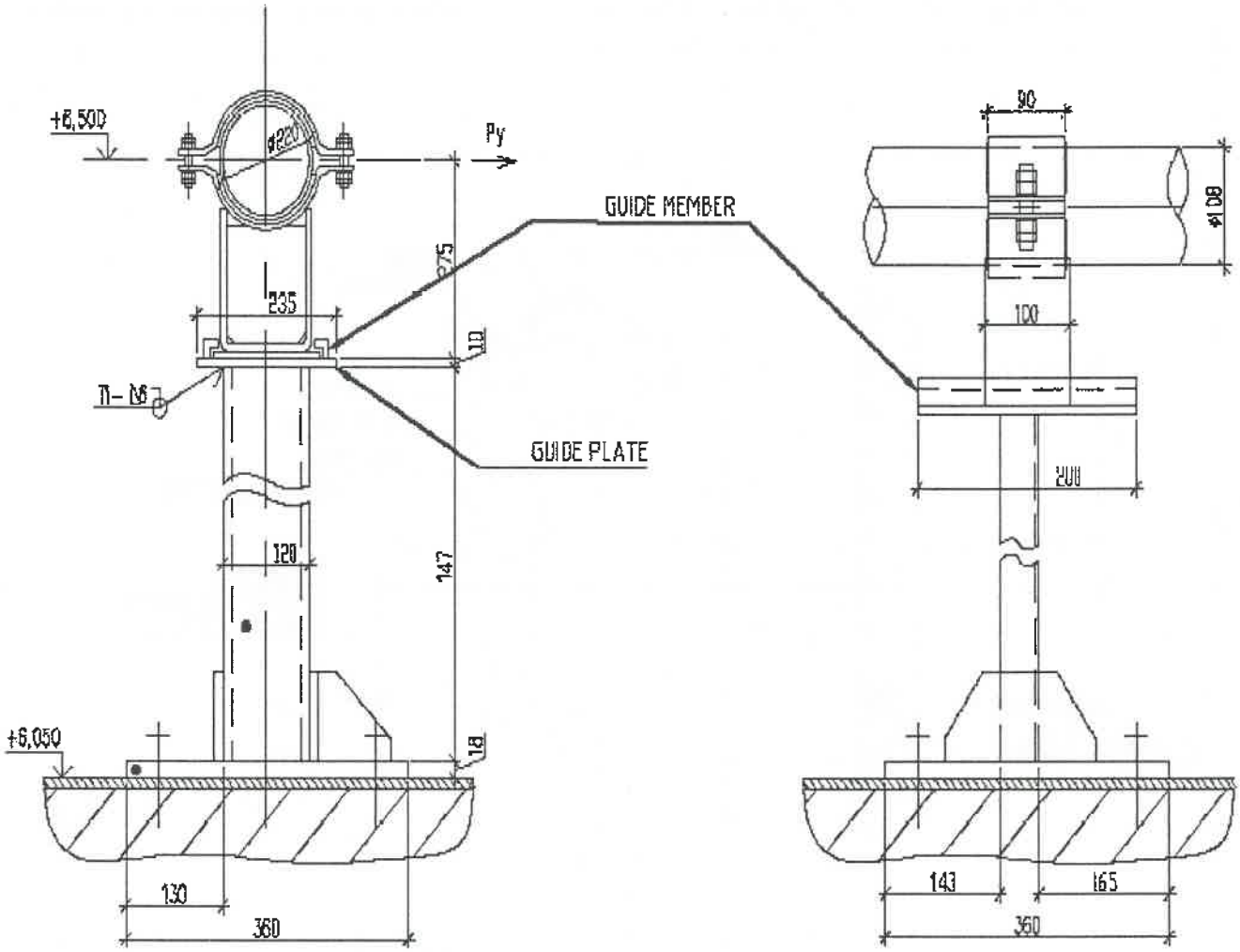
4. After completion of erection, graphite powder shall be applied between the contact surfaces.
5. Welding of saddle to the pipeline shall be carried out carefully to avoid any damage to the pipeline.



15.1.2 SLIDING GUIDE SUPPORT/GUIDE SUPPORTS:

1. In addition to the parts covered in simple sliding supports, Guide supports have an additional member called guide plate (refer image below) –
2. The guide plates are welded on to the supporting structure and the body of support rests on the guide plate, within the guide.
3. There shall be free movement between the body of support and the guide plates.
4. Ensure that body of support rests on the base plate. Also, graphite powder shall be applied on the mating surfaces.
5. Uniform gap shall be maintained between the guide members and the body of support.
6. Horizontal pipelines are provided with single guide plate while vertical pipelines will be provided with double guide plates.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

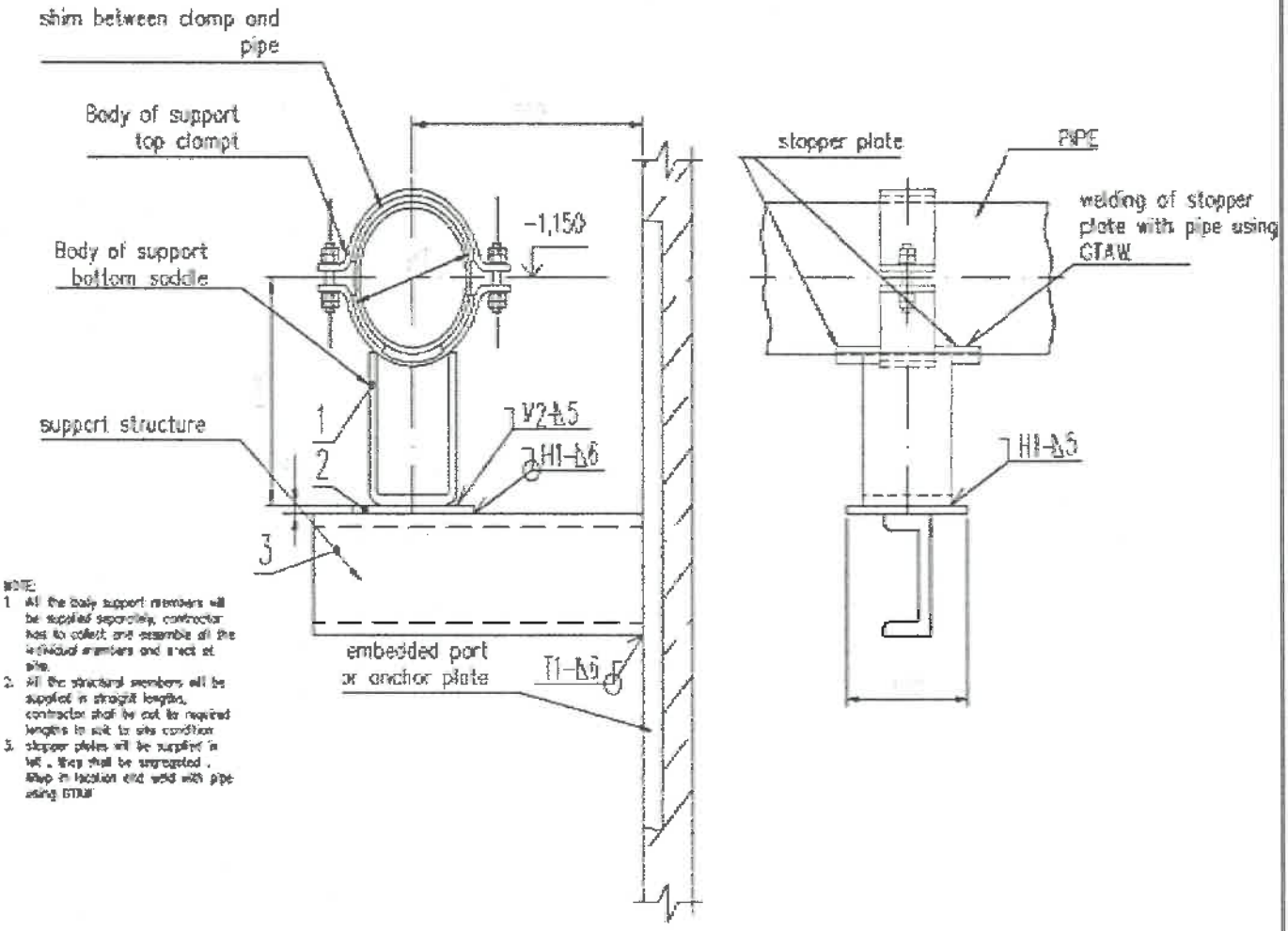


15.1.3 FIXED OR IMMOVABLE SUPPORT:

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

In Fixed Supports, the movement of the body of support is restricted in all directions. This is achieved by welding the body of support to the pipelines and the structural member (refer the image below) –

TYPICAL SKETCH OF FIXED SUPPORT

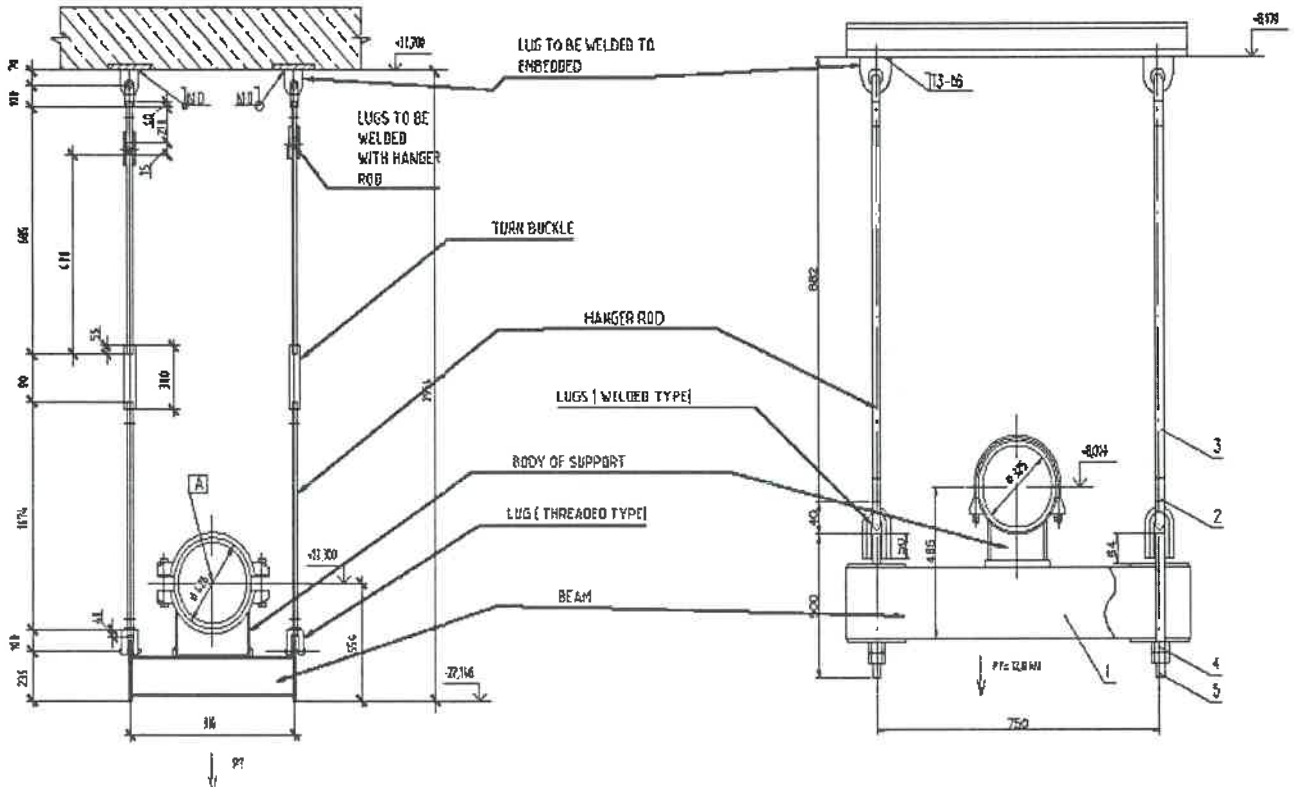


1. The body of support is directly welded to the resting plate. Additionally, stopper plates are welded on the pipe surface adjacent to the support bottom clamp on either side of the support to restrict relative movement of the pipe, making the support fixed.
2. Material of stopper plates is similar to the pipe parent material. These stopper plate will be welded using GTAW process.
3. For small bore pipe supports, body of support shall be directly welded to the pipe, without any clamps. This welding shall be carried out by GTAW process, taking care not to damage the pipe.

15.1.4 RIGID HANGER SUPPORTS:

1. Hanger supports are used for both horizontal and vertical runs of pipes. They can be of single or double rod type.
2. Hanger supports have following additional components viz. lugs, rods (supplied in straight length, also dia. May vary from 8 mm to 40 mm), turn buckles, support clamps, fastening clamps, eyes (dia. From 8 mm to 40 mm) etc. (refer image below) –

TYPICAL ARRANGEMENT OF HANGER SUPPORT

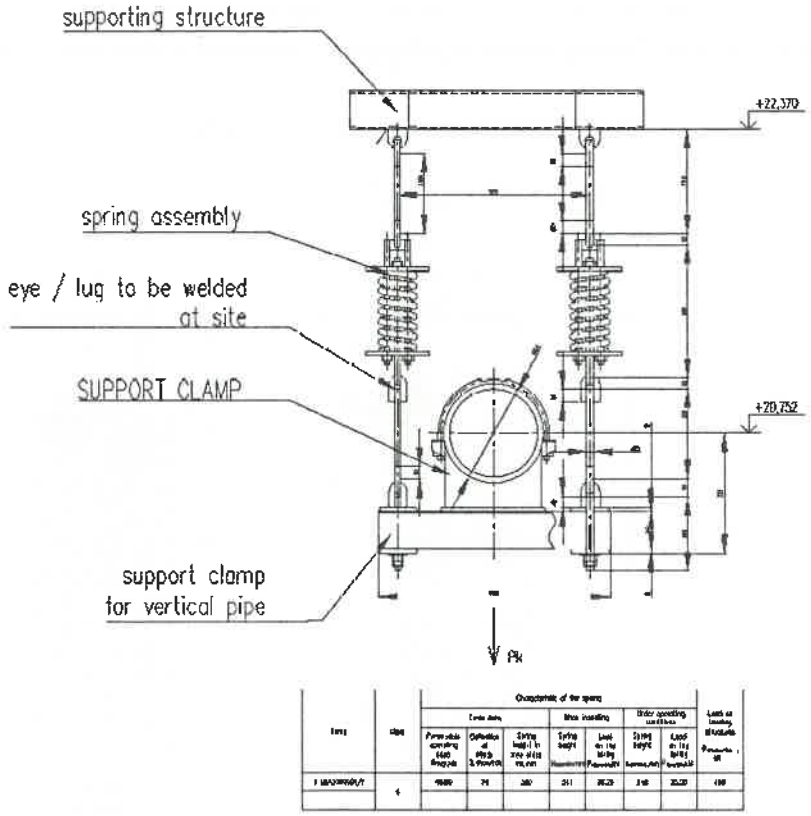


3. The hanger support erection shall be planned and sequenced to ensure loading of all hangers.
4. For hanger supports with turnbuckle, care shall be taken to ensure use of correct turnbuckle for the particular support.
5. Rods shall be cut and ground as per the field measurement; all the clamps and the eyes shall be segregated, eyes shall be welded to the rods and shall be assembled at site with clamp and the supporting member. The supporting member may be an embedded part or a metal structure.
6. In case of erection of hanger supports in location, utmost care shall be taken to ensure tightness of hangers. Hanger shall be loaded by adjusting the turn buckle.

15.1.5 SPRING HANGER SUPPORTS:

1. The main components of spring hanger supports are body of support, clamps, supporting beam, hanger rods, eyes / lugs, shims, spring assembly etc. (refer images below) –
2. The Spring hanger supports are supported from embedded parts, anchor plates or on the nearest metal structure and may be mounted on vertical or horizontal pipe runs.
3. Rods are to be cut and ground as per field measurements and lugs / eyes shall be welded to the rods.

SPRING HANGER IN HORIZONTAL LINE



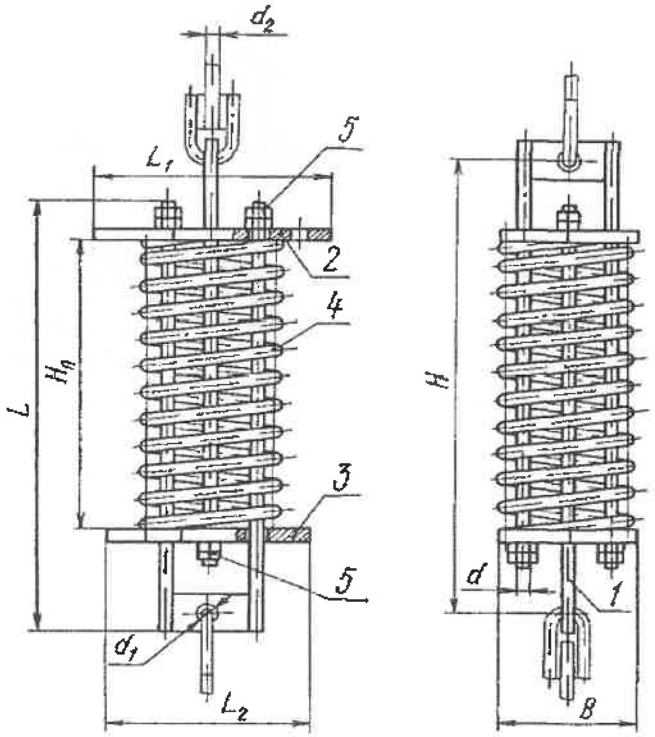
15.1.6 SPRING ASSEMBLIES:

2. Spring assemblies are classified based on the stiffness, compression, free height of the spring and identified by unique Russian standard. They are not interchangeable. (refer image below)
3. The spring tag number is to be identified w.r.t drawing of the particular system.
4. All spring hanger supports have a requirement of spring heights to be maintained during erection and during operation.
5. All springs (supplied in free state) shall be checked for dimension of free height, wire diameter etc. before assembling, as per applicable WDs and OST standards.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

6. All the parts of the spring assembly support are segregated and the springs are assembled with the respective spring plates and rods using fasteners.
7. Springs shall be assembled and dimensions shall be set as per the approved drawings.
8. A jig / fixture shall be fabricated so that the spring assembly can be pre-compressed and locked to the required dimension, as per WD requirements, before taking to site for erection.
9. Lock of the springs shall be released only during floating or after the completion of hydraulic test by getting clearance from ENC/NPCIL. If the spring height is found to vary after releasing of lock, it shall be readjusted. Post this, the assembly may be erected and welded.
10. For vertical pipelines, spring assemblies will be provided with stopper plates (supplied as free issue) for taking the load of the pipe. These plates shall be welded to the pipe using GTAW process.
11. Arrangement of typical spring support assembly on horizontal and vertical pipelines is given below –

TYPICAL SPRING ASSEMBLIES

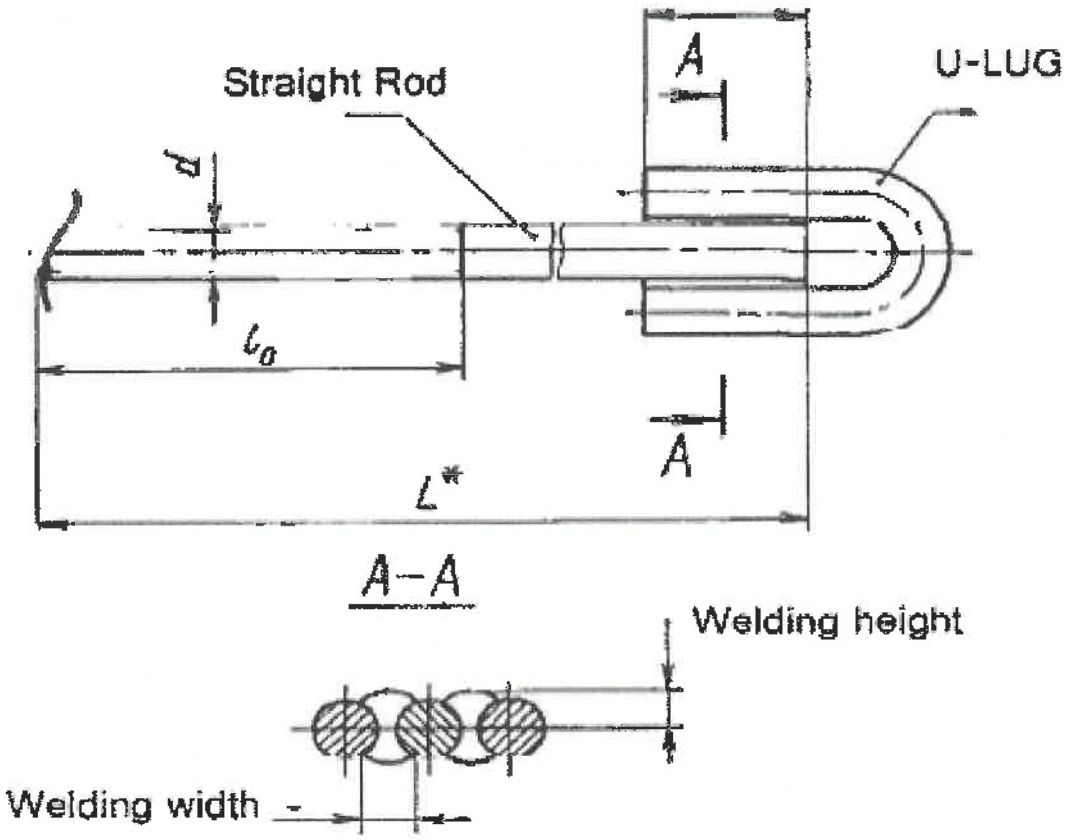


1) Clamping Rod 2) Spring locking plate 3)Spring locking plate 4) Spring

5) Lock Nut

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

Arrangement of LUG & ROD Welding Arrangement



15.2 PRECAUTIONS DURING SUPPORT ERECTION:

1. Even though diameter and supports are same for pipes of different systems, mixing of supports must be avoided.
2. Care shall be taken while welding stopper plates. The small bore pipe supports shall not be directly welded to pipe; as there is a risk of puncturing the pipe.

16 VALVE TESTING:

All valves are to be tested for leak tightness prior to installation. Valve testing shall be done at Valve testing facility available at site as per approved procedure I46.KK34.0.0.QA.QFS.WD031.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

17 VALVE ERECTION:

(1) Various types of valves are to be mounted in the process system piping as wedge valves, butterfly valves, ball valves, swing check valves. List of valves mentioned in Annexure D.
(2) Valves shall be identified with KKS and tag nos.
(3) Valves shall be transported to the installation site in manufacturers' packing
(4) Name plate details on the valves to be checked. Size, ratings shall be compared with WD parameters. Non conformity shall be reported to M/s NPCIL.
(5) Physical damage, if any, shall be reported to ENC/NPCIL
(6) Ensure passport during installation of valves

17.1 WEDGE GATE

(7) Valves can be installed on horizontal and vertical pipelines.
(8) The dimensions of the pipes to be joined with the valves are specified in TU-AS00-001-AG-2008
(9) Valves are required to be erected in horizontal pipeline, vertical pipeline or in any other orientation as per the requirement specified in the working drawing and valves to be erected as per the flow direction mentioned in the body of valve.
(10) Before welding, partially open the wedge.
(11) Foreign particles, debris, if any, shall be removed before carrying out fit up and welding of valves
(12) The fastening material, plugs, caps on the valves and accessories not to be opened and loosened without NPCIL approval

17.2 BUTTERFLY VALVES

(13) Valves must not be transported by control elements (flywheels or electric drives). For this purpose, 4 bolts are provided around the perimeter of the body or the hub of the body and the holes in the ribs.
(14) During transportation and storage, the butterfly valve disk must be in the fully closed position
(15) Before installation, the valve is removed from the package and all protective covers (plugs) are removed. A visual inspection is performed to check for any defects occurring during transport and storage. In case of a damage that affects the product's performance, the decision of installation to be made by ENC/NPCIL, if necessary with the involvement of manufacturer's representatives.
(16) Inhibitors and preservatives are removed from the internal and external surfaces of the valve
(17) Valves are installed on horizontal and vertical pipelines in such a way that the arrow on the body corresponds to the direction of flow of the working fluid, and the axis of rotation of the valve disk is in a horizontal position
(18) Before installing the valve, the pipe on which the valve will be installed is to be cleaned of all contaminants, otherwise damage to the sealing unit may occur.

(19) Check for the cleanliness and condition of the seal before installation

17.3 BALL VALVES

(20) The valve shall be installed on the pipeline in places convenient for maintenance with provision of straight sections of the pipeline before and after the valve with a length of at least 5 external diameters.

(21) Welding shall be performed with cooling to prevent overheating of the fluoroplastic ring

17.4 SWING CHECK VALVES

(22) When installing the Valve in the pipeline the disk should be in a closed position

(23) Put the Valve between the flanges in such a way that not to damage the contact (sealing) surfaces at the end faces of the body

(24) At carrying out the installation works the Valve should be reliably fixed with sling devices through the eye bolt.

(25) The nuts during the Valve installation in the pipeline are to be tightened by a spanner without any application of extension devices. Cocking and over tightening are not allowed

18 HYDRO TEST:

a. After completion of erection activities including welding, the entire piping system shall be checked for the conformity with reference to scheme and WDs
b. Hydro test shall be carried out only after the completion of all hot works in the piping system.
c. Hydraulic test loops have to be identified from P&I diagrams covering same test pressure.
d. Wherever isolation valves are available, the hydraulic test can be performed with the valves as test boundary. During HT, all hangers are to be locked and subsequently the same is to released after hydro test.
e. Compilation all the loop wise reports such as line erection report, weld joint history sheet, support erection report, valve erection reports, list of terminal points, list of exemption if any shall be completed
f. Mechanical clearance shall be obtained from NPCIL prior to start of water filling.
g. The permitted chloride content of water shall be less than 25ppm. Test certificate shall be submitted before water filling.
h. The CRR (Circuit Release Report) format shall be filled and submitted with enclosures. Prior to hydro test the CRR to be accepted by concerned NPCIL departments for a respective system.
i. Hydro test pressure shall be as per the respective working document.
j. Hydro test shall be as per the procedure I46-KK-34-0-0-CC-WPR-WD030.
k. After completion of hydro-test of pipeline, re-preservation to be carried out as per approved work procedure for de-preservation and re-preservation of pipeline I46.KK34.0.0.QA.QFS.WD 006

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

19 JOB HAZARD ANALYSIS:

a) Approved procedure for Scaffolding work shall be followed as per I46/KK34/0/0/OT/JHA/WD001.
b) Approved procedure for Materials Transportation shall be followed as per I46/KK34/O/O/OT/JHA/WD002.
c) Approved procedure for Hot work (Welding, grinding) work shall be followed as per I46/KK34/0/0/OT/JHA/WD001.
d) Approved procedure for Height work shall be followed as per I46/KK34/0/0/OT/JHA/WD009.
e) Approved JHA procedure for carrying out Radiography testing as per I46/KK34/O/O/OT/JHA/WD012.

20 INSPECTION AND ACCEPTANCE:

- Inspection activities shall be carried out as per approved QP-I46.KK34.0.0.QA.QP-WD039

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

21 ACCEPTANCE CRITERIA:

21.1 FITUP:

1. Dimensional requirements for various groove designs as specified by working document shall be as per table π3.1 to π3.65 of PNAEG-7-009-89.
2. Tolerance on permissible displacements of edges in butt joints are as below:
3. Displacement shall be merged with a 1:3 taper.

Sl.No.	Thickness (mm)	Maximum permissible displacements (mm)
1	5	1
2	6	1.1
3	8	1.3
4	10	1.5
5	12	1.7
6	14	1.9
7	16	2.1
8	18	2.3
9	20	2.5
10	24	2.9

4. Root gap shall be as per Annexure VII

21.2 WELDING:

21.2.1 Root Concavity:

1. When welding the swivelling butts of piping parts without backing rings, it is permitted to have a continuous or intermittent concavity of the weld root on the internal side not exceeding the following dimensions. LP/EP or Concavity/Convexity penetration shall be made as given in Appendix – 2 of PNAEG – 7 – 17 – 89 during radiography testing for weld joint root.

Sl.No.	Rated thickness of pipe wall thickness in mm	Permissible height (depth) of root concavity of weld root in mm
1	From 1.0 to 1.8 mm inclusive	0.2
2	Over 1.8 to 2.8 mm inclusive	0.4
3	Over 2.8 to 4.0 mm inclusive	0.6
4	Over 4.0 to 6.0 mm inclusive	0.8
5	Over 6.0 to 8.0 mm inclusive	1 .0
6	Over 8.0 to 12.0 mm inclusive	1 .2
7	Over 12.0 mm inclusive	1 .5

21.2.2 Reinforcement / Excess Penetration(EP):

The dimensions of the continuous of intermittent convexity of the weld should not exceed the following dimensions:

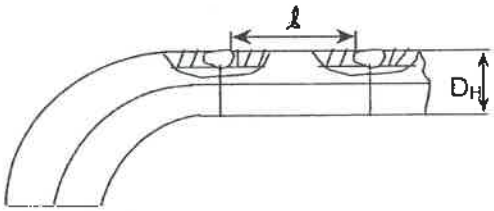
1. Rated inside diameter of pipe up to 25 mm inclusive, the permissible size of the convexity of weld should not exceed to 1 mm.
2. Rated inside diameter of pipe over 25 to 150 mm inclusive, the permissible size of the convexity of weld should not exceed to 2.0 mm.
3. Rated inside diameter of pipe over 150 mm, the permissible size of the convexity of weld should not exceed to 2.5 mm.

21.2.3 Permissible surface inclusions:

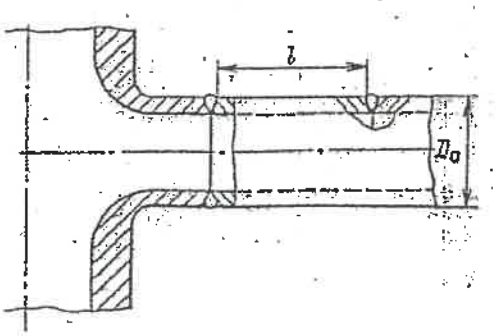
1. The norms of permissible individual surface inclusions and pores for the welded joints and buttered edges are as per ANNEXURE - I.

21.3 DIMENSIONAL TOLERANCES FOR FABRICATION:

1. The deviation of the outer diameter and ovality of the pipes shall not exceed 1% against its nominal value but it should not be more than 20mm.
2. The ovality of the bent sections of pipes for the parts of the pipelines (branches, elbows) should not exceed 8%.
3. The distance between the edge of the butt joint and the initial point of the curvilinear section of the bent of the pipelines with the nominal outer diameter of 100mm and over should be not less than 100mm.
4. The distance between the successive joints of the pipelines with the nominal outer diameter up to 100mm should be not less than the nominal outer diameter of the pipe.
5. The below limits are applicable for the distance between the location of initial butt weld and branch welds as shown below.



Arrangement of Welds When Welding the Branch to the Pipe:
if DH > 100mml >= 100 mm
If DH <= 100mm l >= DH

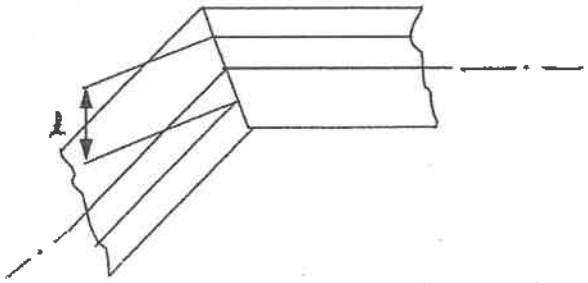


Arrangement of Joints used to Weld the Pipelines to the Branch:
if DH > 100mml >= 100 mm
If DH <= 100mm l >= DH

21.4 Welded joints in the Laterals consisting of sectors:

1. In case of the laterals consisting of sectors and made of the welded pipes, the distance between the junction of the circumferential joint of the lateral and longitudinal or spiral joints of sectors or pipes should not less than 100mm as shown in figure below.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

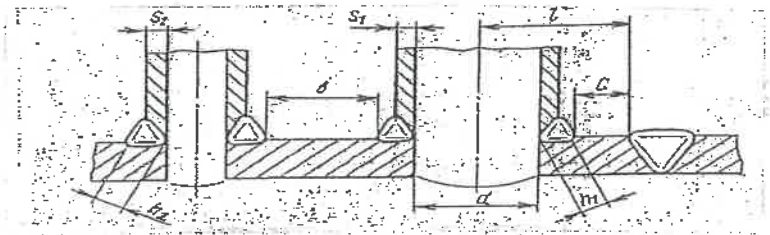


Arrangement of the Welded joints in the Laterals Consisting of Sectors (l >= 100mm)

2. The above distance is measured between the conjugate points of the axis of the appropriate joints.

21.5 Arrangement of the union welded joints:

1. The distance (C) between the edges of the nearest corner joints to weld the branches (unions) of pipes to the equipment or pipeline should be not less than three design height values of the corner joint or three nominal thickness values of the walls of the branches or pipes being welded.
2. The distance (l) between the edge of the butt joint of the equipment or pipeline and the centre of the nearest hole should be not less than 0.9 of the hole diameter.



Arrangement of the Union Welded Joints

$C \geq 3h_1$; $C \geq 3S_1$; $l \geq 0.9\,d$;
$b \geq 3h_2$; $b \geq 3S_2$ ($S_2 > S_1$, $h_2 > h_1$).

3. In case of different height or thickness values their maximum value should be taken. These requirements do not cover the pipes welded into the pipe plates (grids), collectors, production channel pipe plates, channels of the control and protection system and other channels as shown in figure above.
4. Other dimensional tolerance for fabrication and erection shall be followed as specified in the relevant working document.

22 RECORDS:

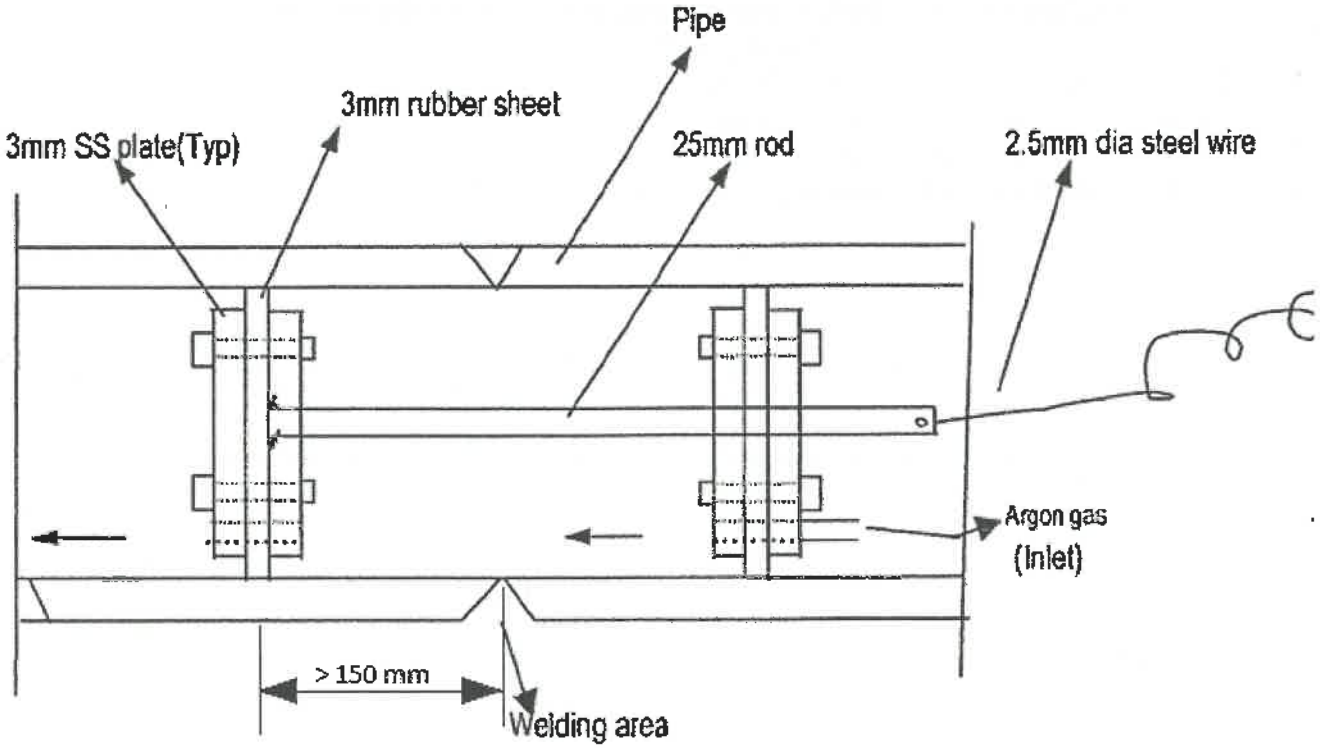
1. All the formats regarding piping fabrication and erection shall be provided as per the BHEL's QAP approved by NPCIL.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

23 ENCLOSURES:

1. SKETCH – 1 : A typical arrangement of removable of purging dam.
2. ANNEXURE – I : The norms of permissible individual surface inclusions and pores for the welded joints and buttered edges.
3. ANNEXURE – II : Table of initial purging time for various pipe diameters.
4. ANNEXURE – III : List of Applicable WDs
5. ANNEXURE – IV : Scope of NDT
6. ANNEXURE – V : List of supports
7. ANNEXURE - VI : List of Valves
8. ANNEXURE – VII : Root gap

SKETCH I
TYPICAL ARRANGEMENT OF REMOVABLE DAM



BLANK PAGE

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

ANNEXURE – I

NORMS OF PERMISSIBLE SURFACE INCLUSIONS IN WELDED JOINTS

Rated thickness of welded (coated) parts, mm	Permissible maximum size of inclusion in welded joints (weld surfacing) of categories, mm					Maximum permissible number of inclusions on any 100 mm of the length of welded joint (coating) of categories:				
	I_H	II_H	I	II	III	I_H	II_H	I	II	III
Up to 2 inclusive	-	-	-	-	0.3	-	-	-	-	2
Over 2 to 3 inclusive	-	-	-	0.3	0.4	-	-	-	2	3
Over 3 to 4 inclusive	-	-	0.3	0.4	0.5	-	-	2	3	4
Over 4 to 5 inclusive	-	0.3	0.4	0.5	0.6	-	2	2	3	4
Over 5 to 6 inclusive	0.3	0.4	0.5	0.6	0.8	2	2	2	3	4
Over 6 to 8 inclusive	0.4	0.6	0.8	1.0	2.0	2	2	3	4	5
Over 8 to 10 inclusive	0.4	0.6	0.8	1.0	1.2	2	3	3	4	5
Over 10 to 15 inclusive	0.6	0.8	1.0	1.2	1.5	3	3	3	4	5
Over 15 to 20 inclusive	0.8	1.0	1.2	1.5	2.0	3	3	4	5	6
Over 20 to 40 inclusive	1.0	1.2	1.5	2.0	2.0	3	4	4	5	6
Over 40 to 100 inclusive	1.2	1.5	1.5	2.0	2.5	4	4	5	6	8
Over 100 to 200 inclusive	1.5	1.5	1.5	2.0	2.5	4	5	6	7	8
Over 200	1.5	1.5	1.5	2.0	2.5	5	6	7	8	9

NOTE:

1. Inclusions of a maximum actual size up to 0.2 mm are disregarded irrespective of the rated thickness of welded (coated) parts both when counting the number of individual inclusions and when considering the distance between inclusions.
2. Any combination of inclusions (individual clusters, groups of inclusions) which may be inscribed into a square with a side size not exceeding the maximum permissible size of an individual inclusion may be considered as a single solid inclusion.

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

ANNEXURE – II

INITIAL PURGING TIMES FOR VARIOUS PIPE DIAMETERS

SL. NO	SIZE	CROSS SECTION AREA (sq. mm)	VOLUME PER METER (litres)	SIX TIMES OF VOLUME litres	MINIMUM FLOW RATE (lpm)	TIME REQD. (minutes)	REMARKS
1	15	177	0.18	1.06	5.0	0.21	
2	20	341	0.31	1.89	5.0	0.38	
3	25	491	0.49	2.95	5.0	0.59	
4	32	805	0.80	4.83	5.0	0.97	
5	40	1257	1.26	7.54	5.0	1.51	
6	50	1964	1.96	11.79	5.0	2.36	
7	65	3320	3.32	19.92	5.0	3.98	
8	80	5029	5.03	30.17	5.0	6.03	
9	100	7857	7.86	47.14	5.0	9.43	
10	125	12277	12.28	73.66	12.5	5.89	
11	150	17679	17.68	106.07	12.5	8.49	
12	200	31429	31.43	188.57	12.5	15.09	
13	250	49107	49.11	294.64	15.0	19.64	
14	300	70714	70.71	424.29	15.0	28.29	
15	350	96250	96.25	577.50	15.0	38.05	
16	400	125714	125.71	754.29	20.0	37.71	
17	450	159107	159.11	954.64	20.0	47.73	
18	500	196429	196.43	1178.57	25.0	47.14	
19	600	282857	282.86	1697.14	25.0	67.89	

NOTE: 1. Time required shown in above table is based on 1M dam distance.
2. Time required for various dam distances shall be the time shown above multiplied by the actual dam distance measured in meters.
3. For reducing the purging time the flow rate can be increased.
4. In any case, minimum purging time required shall be as calculated above or 10 minutes whichever is more.

ANNEXURE – III
LIST OF WDS

ANNEXURE III		
List of Applicable WDs		
SL.NO	SYSTEM KKS	WD REFERENCE
1	LCP	R01.KK34.30/40UMA.LCP.TM.OK.WD001-rev0
		DCN-DSG34-3201-20
		DCN-DSG34-3307-20
		R01.KK34.30/40UMA.LCP.TM.OK.WD002 rev0
		R01.KK34.30/40UGZ.LCP.TM.OK.WD002 rev0
2	LDN	R01.KK34.30/40UMA.LDN.TM.OK.WD001 rev0
		DCN-DSG34-4835-21
		DCN-DSG34-1901-19
		DCN-DSG34-4836-21
		DCN-DSG34-1829-19
3	LFN	R01.KK34.30/40UMA.LFN.TM.OK.WD001-rev0
		DCN-DSG34-4858-21
		DCN-DSG34-2468-19
		DCN-DSG34-4859-21
		DCN-DSG34-2475-19
4	JEA50	R01.KK34.30/40UMA.JEA50.TM.OK.WD001-rev1
		R01.KK34.30/40UMA.JEA50.TM.OK.WD002-rev1
		DCN-DSG34-2532-19
		DCN-DSG34-2533-19
5	LCN	R01.KK34.30/40UMA.LCN.TM.OK.WD001-rev1
		DCN-DSG34-405-18
		DCN-DSG34-406-18
6	LCS	R01.KK34.30/40UMA.LCS.TM.OK.WD001 rev0
		R01.KK34.30/40UMA.LCS50.TM.OK.WD001-rev0
7	QUB	R01.KK34.30/40UMA.QUB.TM.OK.WD001-rev0
		DCN-DSG34-2603-20
		DCN-DSG34-2602-20
8	LDB	R01.KK34.30/40UMA.LDB.TM.OK.WD001-rev0
		DCN-DSG34-4861-21
		DCN-DSG34-1538-19
		DCN-DSG34-4867-21
		DCN-DSG34-1539-19
9	LDF	R01.KK34.30/40UMA.LDF.TM.OK.WD001-rev1
		DCN-DSG34-2928-20
		DCN-DSG34-2929-20
10	LDP	R01.KK34.30/40UMA.LDP.TM.OK.WD001 rev0
		R01.KK34.30/40UMA.LDP.TM.OK.WD002-rev0
11	LDR	R01.KK34.30/40UMA.LDR.TM.OK.WD001 rev0
		DCN-DSG34-3855-20
		DCN-DSG34-1508-19
		DCN-DSG34-3856-20
		DCN-DSG34-1512-19
		TAR-S-3601
		TAR S-3592
		TAR-S-3600
		TAR S-3591
12	PGB 84	R01.KK34.30/40UMA.PGB84.TM.OK.WD001-rev1
13	QUC	R01.KK34.30/40UMA.QUC.TM.OK.WD001 rev1
14	QUG	R01.KK34.30/40UMA.QUG.TM.OK.WD001 rev2
		DCN-DSG34-6322-22
		DCN-DSG34-6323-22
15	QUH	R01.KK34.30/40UMA.QUH.TM.OK.WD001 rev0
		DCN-DSG34-5938-22
		DCN-DSG34-1353-19
		DCN-DSG34-5939-22
		DCN-DSG34-1311-19
16	LAA	R01.KK34.30/40UMA.LAA.TM.OK.WD001-rev1
		DCN-DSG34-6332-22
		DCN-DSG34-6333-22
17	LAB	R01.KK34.30/40UMA.LAB.TM.OK.WD001 rev1
		R01.KK34.30/40UMA.LAB.TM.OK.WD002 rev2
		R01.KK34.30/40UMA.LAB.TM.OK.WD003 rev1
18	LAC	R01.KK34.30/40UMA.LAC.TM.OK.WD001 rev1
		DCN-DSG34-2282-19
		DCN-DSG34-1987-19
		R01.KK34.30/40UMA.LAC.TM.OK.WD002-rev1
		R01.KK34.30/40UMA.LAC.TM.OK.WD003-rev1
19	LAH	R01.KK34.30/40UMA.LAH.TM.OK.WD001-rev1
		R01.KK34.30/40UMA.LAH.TM.OK.WD002-rev1
		DCN-DSG34-4417-21
		DCN-DSG34-4416-21
		DCN-DSG34-6416
		DCN-DSG34-6417
		DCN-DSG34-6420
		DCN-DSG34-6421
20	LAJ	R01.KK34.30/40UMA.LAJ.TM.OK.WD001 rev0
		DCN-DSG34-3372-20
21	QUA	R01.KK34.30/40UMA.QUA.TM.OK.WD001 rev0
		DCN-DSG34-973-19

ANNEXURE – IV
SCOPE OF NDT

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

ANNEXURE IV

NDE requirement

SL.NO	WD Reference	Quality Category	Category of Pipeline	No of Pipeline	As per Quality Assurance Table	Scope of Inspection						
						VT	DPT	RT		MPT	UT	Hydro Test
								OD≤325	OD>325			
1	R01.KK34.30/40UMA.LCP.TM.OK.WD001	QA3		I	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
				II,III	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				ANGLE JOINT	PNAE G-07-010-89	100%	NA	50	NA	NA	NA	100%
				I-III(AUXILLARY PARTS)	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	NA
2	R01.KK34.30/40UMA.LCP.TM.OK.WD002	QA3		III	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				III(AUXILLARY PARTS)	PNAE G-07-010-89	100%	10	NA	NA	NA	NA	NA
			SN 527-80 VB	I,II,IV	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
3	R01.KK34.30/40UGZ.LCP.TM.OK.WD002	QA3		I-IV	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
				I-IV(SECONDARY PARTS)	PNAE G-07-010-89	100%	10	NA	NA	NA	NA	NA
4	R01.KK34.30/40UMA.LDN.TM.OK.WD001	QA3	SN 527-80 VB	I-VII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
5	R01.KK34.30/40UMA.LFN.TM.OK.WD001	QA3		XVI,XVII,XVIII	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
		QA3	SN 527-80 VB	I,III,IV,VI,XI,XIII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
		QA3	SN 527-80 IA	II,V,VII,VIII,IX,X,XII,XIV,XV	RD 34-10.030-89	100%	NA	20	NA	NA	NA	100%
6	R01.KK34.30/40UMA.JEA50.TM.OK.WD001	QA3	SN 527-80 VB	I-V	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
7	R01.KK34.30/40UMA.JEA50.TM.OK.WD002	QA3		II,III	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
			SN 527-80 IB	I	RD 34-10.030-89	100%	NA	20	NA	NA	NA	100%
8	R01.KK34.30/40UMA.LCN.TM.OK.WD001	QA3		I-V,VII	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				VI,VIII		100%	NA	10	NA	NA	NA	100%
			SN 527-80 IIB	IX	RD 34-10.030-89	100%	NA	10	NA	NA	NA	100%
			SN 527-80 IIIB	X	RD 34-10.030-89	100%	NA	2	NA	NA	NA	100%
			SN 527-80 VB	XI	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
				Fillet		100%	NA	NA	NA	NA	NA	100%
9	R01.KK34.30/40UMA.LCS.TM.OK.WD001	QA3		I-VII,IX,XIII	PNAE G-07-010-89	100%	NA	5	NA	NA	NA	100%
				VIII		100%	NA	25	NA	NA	NA	100%
				II		100%	NA	10	NA	NA	NA	100%
				I-VII,IX,XIII(AUXILLARY PARTS)		100%	25	NA	NA	NA	NA	NA
			SN 527-80 VV	X,XI,XII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
10	R01.KK34.30/40UMA.QUB.TM.OK.WD001	QA3		I,II	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
			SN 527-80 VB	I,IV	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%

ANNEXURE IV

NDE requirement

SL.NO	WD Reference	Quality Category	Category of Pipeline	No of Pipeline	As per Quality Assurance Table	Scope of Inspection						
						VT	DPT	RT		MPT	UT	Hydro Test
								OD≤325	OD>325			
11	R01.KK34.30/40UMA.LDB.TM.OK.WD001	QA3	SN 527-80 VB	I-III, V-XII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
			SN 527-80 Iaa	IV		100%	NA	20	NA	NA	NA	100%
12	R01.KK34.30/40UMA.LDF.TM.OK.WD001	QA3	SN 527-80 VB	I,II,IX	RD 34-10.030-89	100%	NA	10	25	NA	NA	NA
				CONNECTIONS	PNAE G-07-010-89	100%	10	50	NA	NA	NA	100%
13	R01.KK34.30/40UMA.LDP.TM.OK.WD001	QA3	SN 527-80 VB	VIII-XIII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
			SN 527-80 IAa	I-VII	RD 34-10.030-89	100%	NA	20	NA	NA	NA	100%
14	R01.KK34.30/40UMA.LDP.TM.OK.WD002	QA3	SN 527-80 I Aa	I-VII	RD 34-10.030-89	100%	NA	20	NA	NA	NA	100%
			SN 527-80 VB	VIII-XIII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
15	R01.KK34.30/40UMA.LDR.TM.OK.WD001	QA3	SN 527-80 VB	I-XX	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
16	R01.KK34.30/40UMA.PGB84.TM.OK.WD001	QA3	SN 527-80 VV	I,II,III	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
17	R01.KK34.30/40UMA.QUC.TM.OK.WD001	QA3		II,IV	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				V,X,XIII	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
			SN 527-80 IVB	I,III	RD 34-10.030-89	100%	NA	1	NA	NA	NA	100%
			SN 527-80 VB	IV-IX,XI,XII,XIV	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
18	R01.KK34.30/40UMA.QUG.TM.OK.WD001	QA3		I	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
			SN 527-80 VB	II,III	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
19	R01.KK34.30/40UMA.QUH.TM.OK.WD001	QA3	SN 527-80 VB	II-VII,IX-XII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
			SN 527-80 IVB	I	RD 34-10.030-89	100%	NA	1	NA	NA	NA	100%
				VIII	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
20	R01.KK34.30/40UMA.LAA.TM.OK.WD001	QA3		I,II,III,IV (T<=5.5MM)	PNAE G-07-010-89	100%	NA	5	10	NA	10	100%
				I,II,III,IV (T>5.5MM)		100%	NA	NA	10	NA	10	100%
				I		100%	NA	10	NA	NA	NA	100%
				I,II,III,IV(AUXILLARY PART)		100%	10	NA	NA	NA	NA	NA
21	R01.KK34.30/40UMA.LAB.TM.OK.WD001	QA3		I,II	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
				AUXILLARY PARTS		100%	10	NA	NA	NA	NA	NA
22	R01.KK34.30/40UMA.LAB.TM.OK.WD002	QA3		I,II,III,V	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				AUXILLARY PARTS		100%	25	NA	NA	NA	NA	NA
23	R01.KK34.30/40UMA.LAB.TM.OK.WD003	QA3		I (<=5.5mm)	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				I (>5.5mm)		100%	NA	NA	25	NA	25	100%
				AUXILLARY PARTS		100%	25	NA	NA	NA	NA	NA
24	R01.KK34.30/40UMA.LAC.TM.OK.WD001	QA3		II,III	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
25	R01.KK34.30/40UMA.LAC.TM.OK.WD002	QA3		I	PNAE G-07-010-89	100%	NA	5	NA	NA	NA	100%
			SN 527-80 VV	II,III	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%

ANNEXURE IV												
NDE requirement												
SL.NO	WD Reference	Quality Category	Category of Pipeline	No of Pipeline	As per Quality Assurance Table	Scope of Inspection						
						VT	DPT	RT		MPT	UT	Hydro Test
								OD≤325	OD>325			
26	R01.KK34.30/40UMA.LAC.TM.OK.WD003	QA3	SN 527-80 VV	I	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
27	R01.KK34.30/40UMA.LAH.TM.OK.WD001	QA3		I(<=5.5mm)	PNAE G-07-010-89	100%	NA	5	NA	NA	NA	100%
				I(>5.5mm)		100%	NA	NA	NA	NA	10	100%
				II		100%	NA	25	NA	NA	NA	100%
				AUXILLARY PARTS		100%	25	NA	NA	NA	NA	NA
28	R01.KK34.30/40UMA.LAH.TM.OK.WD002	QA3	SN 527-80 VB	I(<=5.5mm)	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
				I(>5.5mm)		100%	NA	NA	NA	NA	100	100%
				II	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%
				AUXILLARY PARTS		100%	25	NA	NA	NA	NA	NA
29	R01.KK34.30/40UMA.LAJ.TM.OK.WD001	QA3		II	PNAE G-07-010-89	100%	NA	10	NA	NA	NA	100%
30	R01.KK34.30/40UMA.QUA.TM.OK.WD001	QA3	SN 527-80 VB	I,III	PNAE G-07-010-89	100%	NA	25	NA	NA	NA	100%
31	R01.KK34.30/40UMA.LCS.TM.OK.WD001	QA3	SN 527-80 VV	I-VII,IX,XIII	PNAE G-07-010-89	100%	NA	5	NA	NA	NA	100%
				VIII		100%	NA	25	NA	NA	NA	100%
				II		100%	NA	10	NA	NA	NA	100%
				I-VII,IX,XIII (auxiliary parts)		100%	25	NA	NA	NA	NA	NA
				X-XII	RD 34-10.030-89	100%	NA	NA	NA	NA	NA	100%

Note: Incase of Niobium content in welding materials, 100% DPT shall be carried out

ANNEXURE – V
LIST OF SUPPORTS

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
QUC.WD001	NA	NA	NA
QUG.WD001	NA	NA	NA
QUH.WD001	NA	NA	NA
QUA.WD001	NA	NA	NA
LFN.WD001	NA	NA	NA
JEA50.WD001	NA	NA	NA
PGB84.WD001	1	Sliding Support	219
PGB84.WD001	2	Sliding Support	219
PGB84.WD001	3	Sliding Support	219
PGB84.WD001	4	Sliding Support	219
PGB84.WD001	5	Guide Sliding support	219
PGB84.WD001	6	Immovable support	219
PGB84.WD001	7	Sliding Support	219
PGB84.WD001	8	Rigid Hanger	219
PGB84.WD001	9	Rigid Hanger	219
PGB84.WD001	10	Guide Sliding support	219
PGB84.WD001	11	Rigid Hanger	219
PGB84.WD001	12	Rigid Hanger	219
PGB84.WD001	13	Sliding Support	108
PGB84.WD001	14	Sliding Support	108
PGB84.WD001	15	Sliding Support	108
PGB84.WD001	16	Sliding Support	108
PGB84.WD001	17	Sliding Support	108
PGB84.WD001	18	Sliding Support	108
PGB84.WD001	19	Immovable support	108
PGB84.WD001	20	Sliding Support	89
PGB84.WD001	21	Sliding Support	89
PGB84.WD001	22	Sliding Support	89
PGB84.WD001	23	Sliding Support	89
PGB84.WD001	24	Sliding Support	89
PGB84.WD001	25	Sliding Support	89
PGB84.WD001	26	Sliding Support	89
PGB84.WD001	27	Immovable support	89
PGB84.WD001	28	Sliding Support	89
PGB84.WD001	29	Sliding Support	76
PGB84.WD001	30	Sliding Support	159
PGB84.WD001	31	Sliding Support	89
PGB84.WD001	32	Sliding Support	89
PGB84.WD001	33	Guide Sliding support	89
PGB84.WD001	34	Sliding Support	76
PGB84.WD001	35	Sliding Support	89
PGB84.WD001	36	Immovable support	377
PGB84.WD001	37	Sliding Support	76
PGB84.WD001	38	Sliding Support	76
PGB84.WD001	39	Sliding Support	76
PGB84.WD001	40	Sliding Support	76
PGB84.WD001	41	Sliding Support	377
PGB84.WD001	42	Rigid Hanger	219
PGB84.WD001	43	Rigid Hanger	219
PGB84.WD001	44	Sliding Support	219

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
PGB84.WD001	45	Immovable support	219
PGB84.WD001	46	Guide Sliding support	219
PGB84.WD001	47	Sliding Support	219
PGB84.WD001	48	Sliding Support	219
PGB84.WD001	49	Sliding Support	219
PGB84.WD001	50	Sliding Support	219
PGB84.WD001	51	Rigid Hanger	219
PGB84.WD001	52	Rigid Hanger	219
PGB84.WD001	53	Immovable support	57
PGB84.WD001	54	Immovable support	89
PGB84.WD001	55	Sliding Support	89
PGB84.WD001	56	Sliding Support	89
PGB84.WD001	57	Sliding Support	89
PGB84.WD001	58	Sliding Support	89
PGB84.WD001	59	Sliding Support	89
PGB84.WD001	60	Sliding Support	89
PGB84.WD001	61	Sliding Support	89
PGB84.WD001	62	Immovable support	108
PGB84.WD001	63	Sliding Support	108
PGB84.WD001	64	Sliding Support	108
PGB84.WD001	65	Sliding Support	108
PGB84.WD001	66	Sliding Support	108
PGB84.WD001	67	Sliding Support	108
PGB84.WD001	68	Sliding Support	108
PGB84.WD001	69	Rigid Hanger	108
PGB84.WD001	70	Guide Sliding support	108
PGB84.WD001	71	Sliding Support	57
PGB84.WD001	72	Sliding Support	57
PGB84.WD001	73	Guide Sliding support	57
PGB84.WD001	74	Guide Sliding support	57
PGB84.WD001	75	Sliding Support	159
PGB84.WD001	76	Guide Sliding support	159
PGB84.WD001	77	Guide Sliding support	89
PGB84.WD001	78	Sliding Support	89
PGB84.WD001	79	Sliding Support	76
PGB84.WD001	80	Sliding Support	76
PGB84.WD001	81	Sliding Support	76
PGB84.WD001	82	Immovable support	32
PGB84.WD001	83	Immovable support	57
PGB84.WD001	84	Immovable support	32
PGB84.WD001	85	Guide Sliding support	108
PGB84.WD001	86	Immovable support	108
PGB84.WD001	87	Rigid Hanger	108
PGB84.WD001	88	Immovable support	108
PGB84.WD001	89	Guide Sliding support	108
PGB84.WD001	90	Sliding Support	108
PGB84.WD001	91	Immovable support	32
PGB84.WD001	92	Immovable support	32
PGB84.WD001	93	Immovable support	32
PGB84.WD001	94	Immovable support	32
PGB84.WD001	95	Immovable support	32

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
PGB84.WD001	96	Immovable support	32
PGB84.WD001	97	Immovable support	57
PGB84.WD001	98	Immovable support	89
PGB84.WD001	99	Immovable support	89
PGB84.WD001	100	Guide Sliding support	32
PGB84.WD001	101	Immovable support	32
PGB84.WD001	102	Immovable support	32
PGB84.WD001	103	Immovable support	32
PGB84.WD001	104	Guide Sliding support	219
PGB84.WD001	105	Sliding Support	76
PGB84.WD001	106	Sliding Support	76
PGB84.WD001	107	Guide Sliding support	108
PGB84.WD001	108	Guide Sliding support	57
PGB84.WD001	109	Immovable support	-
PGB84.WD001	110	Immovable support	-
PGB84.WD001	111	Immovable support	32
LCN.WD001	1	Rigid Hanger	57
LCN.WD001	2	Rigid Hanger	57
LCN.WD001	3	Rigid Hanger	57
LCN.WD001	4	Rigid Hanger	57
LCN.WD001	5	Immovable Support	57
LCN.WD001	6	Immovable Support	57
LCN.WD001	7	Rigid Hanger	57
LCN.WD001	8	Rigid Hanger	57
LCN.WD001	9	Rigid Hanger	57
LCN.WD001	10	Immovable Support	57
LCN.WD001	11	Immovable Support	57
LCN.WD001	12	Spring Hanger	57
LCN.WD001	13	Rigid Hanger	57
LCN.WD001	14	Immovable Support	57
LCN.WD001	15	Immovable Support	57
LCN.WD001	16	Spring Hanger	57
LCN.WD001	17	Rigid Hanger	57
LCN.WD001	18	Rigid Hanger	57
LCN.WD001	19	Rigid Hanger	57
LCN.WD001	20	Immovable Support	57
LCN.WD001	21	Immovable Support	57
LCN.WD001	22	Rigid Hanger	25
LCN.WD001	23	Rigid Hanger	25
LCN.WD001	24	Rigid Hanger	25
LCN.WD001	25	Rigid Hanger	25
LCN.WD001	26	Immovable Support	25
LCN.WD001	27	Guide Support	25
LCN.WD001	28	Rigid Hanger	25
LCN.WD001	29	Rigid Hanger	25
LCN.WD001	30	Rigid Hanger	25
LCN.WD001	31	Rigid Hanger	25
LCN.WD001	32	Rigid Hanger	25
LCN.WD001	33	Immovable Support	25
LCN.WD001	34	Guide Support	25
LCN.WD001	35	Rigid Hanger	25

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LCN. WD001	36	Rigid Hanger	25
LCN. WD001	37	Rigid Hanger	25
LCN. WD001	38	Rigid Hanger	25
LCN. WD001	39	Rigid Hanger	25
LCN. WD001	40	Immovable Support	25
LCN. WD001	41	Guide Support	25
LCN. WD001	42	Rigid Hanger	25
LCN. WD001	43	Rigid Hanger	25
LCN. WD001	44	Rigid Hanger	25
LCN. WD001	45	Rigid Hanger	25
LCN. WD001	46	Immovable Support	25
LCN. WD001	47	Guide Support	25
LCN. WD001	48	Rigid Hanger	25
JEA50 WD002	1	FIXED SUPPORT	18
JEA50 WD002	2	GUIDE SLIDING SUPPORT	18
JEA50 WD002	3	GUIDE SLIDING SUPPORT	18
JEA50 WD002	4	RIGID HANGER	18
JEA50 WD002	5	GUIDE SLIDING SUPPORT	18
JEA50 WD002	6	RIGID HANGER	18
JEA50 WD002	7	GUIDE SLIDING SUPPORT	18
JEA50 WD002	8	GUIDE SLIDING SUPPORT	18
JEA50 WD002	9	RIGID HANGER	18
JEA50 WD002	10	GUIDE SLIDING SUPPORT	18
JEA50 WD002	11	SLIDING SUPPORT	18
JEA50 WD002	12	FIXED SUPPORT	18
JEA50 WD002	13	SLIDING SUPPORT	18
JEA50 WD002	14	SLIDING SUPPORT	18
JEA50 WD002	15	SLIDING SUPPORT	18
JEA50 WD002	16	GUIDE SLIDING SUPPORT	18
JEA50 WD002	17	SLIDING SUPPORT	18
JEA50 WD002	18	SPRING HANGER	18
JEA50 WD002	19	SPRING HANGER	18
JEA50 WD002	20	SPRING HANGER	18
JEA50 WD002	21	SLIDING SUPPORT	18
JEA50 WD002	22	SLIDING SUPPORT	18
JEA50 WD002	23	SLIDING SUPPORT	18
JEA50 WD002	24	SLIDING SUPPORT	18
JEA50 WD002	25	SPRING HANGER	18
JEA50 WD002	26	SPRING HANGER	18
JEA50 WD002	27	SPRING HANGER	18
JEA50 WD002	28	SPRING HANGER	18
QUB-WD001	1	GUIDE SLIDING SUPPORT	14
QUB-WD001	2	GUIDE SLIDING SUPPORT	14
QUB-WD001	3	GUIDE SLIDING SUPPORT	14
QUB-WD001	4	GUIDE SLIDING SUPPORT	14
QUB-WD001	5	GUIDE SLIDING SUPPORT	14
QUB-WD001	6	GUIDE SLIDING SUPPORT	14
QUB-WD001	7	GUIDE SLIDING SUPPORT	32
QUB-WD001	8	GUIDE SLIDING SUPPORT	32
QUB-WD001	9	GUIDE SLIDING SUPPORT	32
QUB-WD001	10	GUIDE SLIDING SUPPORT	18

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
QUB-WD001	11	GUIDE SLIDING SUPPORT	32
QUB-WD001	12	GUIDE SLIDING SUPPORT	32
QUB-WD001	13	GUIDE SLIDING SUPPORT	32
QUB-WD001	14	GUIDE SLIDING SUPPORT	32
LCP WD001	1	Guide support	220
LCP WD001	2	Simple hanger	220
LCP WD001	3	Sliding support	159
LCP WD001	4	Sliding guide support	159
LCP WD001	5	Fixed support	25
LCP WD001	6	Sliding support	159
LCP WD001	7	Guide support	159
LCP WD001	8	Sliding support	159
LCP WD001	9	Sliding support	159
LCP WD001	10	Sliding support	159
LCP WD001	11	Sliding guide support	159
LCP WD001	12	Sliding support	159
LCP WD001	13	Fixed support	159
LCP WD001	14	Sliding support	159
LCP WD001	15	Sliding guide support	159
LCP WD001	16	Sliding guide support	159
LCP WD001	17	Sliding guide support	159
LCP WD001	18	Sliding guide support	159
LCP WD001	19	Fixed support	159
LCP WD001	20	Sliding guide support	159
LCP WD001	21	Sliding guide support	159
LCP WD001	22	Sliding guide support	159
LCP WD001	23	Sliding guide support	159
LCP WD001	24	Sliding guide support	159
LCP WD001	25	Guide support	159
LCP WD001	26	Fixed support	159
LCP WD001	27	Guide support	159
LCP WD001	28	Guide support	159
LCP WD001	29	Guide support	159
LCP WD001	30	Guide support	159
LCP WD001	31	Guide support	159
LCP WD001	32	Fixed support	159
LCP WD001	33	Sliding support	108
LCP WD001	34	Sliding support	57
LCP WD001	35	Fixed support	25
LCP WD001	36	Guide support	25
LCP WD001	37	Fixed support	25
LCP WD001	38	Sliding support	57
LCP WD001	39	Sliding support	57
LCP WD001	40	Fixed support	57
LCP WD001	41	Simple hanger	57
LCP WD001	42	Sliding support	57
LCP WD001	43	Fixed support	57
LCP WD001	44	Sliding guide support	57
LCP WD001	45	Sliding guide support	57
LCP WD001	46	Fixed support	159
LCP WD001	47	Guide support	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LCP WD001	48	Guide support	159
LCP WD001	49	Sliding guide support	159
LCP WD001	50	Sliding guide support	159
LCP WD001	51	Fixed support	159
LCP WD001	52	Sliding guide support	159
LCP WD001	53	Sliding guide support	108
LCP WD001	54	Sliding guide support	108
LCP WD001	55	Fixed support	108
LCP WD001	56	Guide support	108
LCP WD001	57	Sliding guide support	108
LCP WD001	58	Slding guide support	108
LCP WD001	59	Fixed support	108
LCP WD001	60	Guide support	108
LCP WD001	61	Guide support	108
LCP WD001	62	Sliding guide support	108
LCP WD001	63	Spring hanger	57
LCP WD001	64	Sliding guide support	57
LCP WD001	65	Fixed support	57
LCP WD001	66	Sliding guide support	57
LCP WD001	67	Sliding guide support	57
LCP WD001	68	Sliding support	57
LCP WD001	69	Sliding support	57
LCP WD001	70	Sliding guide support	57
LCP WD001	71	Sliding support	57
LCP WD001	72	Slidng guide support	57
LCP WD001	73	Slidng support	57
LCP WD001	74	Sliding guide support	57
LCP WD001	75	Sliding support	57
LCP WD001	76	Sliding guide support	57
LCP WD001	77	Sliding support	57
LCP WD001	78	Sliding guide support	57
LCP WD001	79	Simple hanger	57
LCP WD001	80	Fixed support	57
LCP WD001	81	Sliding guide support	57
LCP WD001	82	simple hanger	57
LCP WD001	83	Sliding guide support	57
LCP WD001	84	Sliding guide support	57
LCP WD001	85	Sliding guide support	57
LCP WD001	86	Simple hanger	57
LCP WD001	87	Sliding guide support	57
LCP WD001	88	Sliding guide support	57
LCP WD001	89	Sliding guide support	57
LCP WD001	90	Sliding guide support	57
LCP WD001	91	Simple hanger	57
LCP WD001	92	Sliding guide support	57
LCP WD001	93	Guide support	14
LCP WD001	94	Guide support	14
LCP WD001	95	Guide support	14
LCP WD001	96	Fixed support	VALVE
LCP WD001	97	Simple hanger	57
LCP WD001	98	Sliding guide support	57

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LCP WD001	99	Sliding support	89
LCP WD001	100	Fixed support	89
LCP WD001	101	Guide support	18
LCP WD001	102	Fixed support	VALVE
LCP WD001	103	Guide support	89
LCP WD001	104	Guide support	89
LCP WD001	105	Sliding support	89
LCP WD001	106	Fixed support	89
LCP WD001	107	Sliding guide support	89
LCP WD001	108	Sliding guide support	89
LCP WD001	109	Sliding guide support	89
LCP WD001	110	Sliding guide support	89
LCP WD001	111	Sliding guide support	89
LCP WD001	112	Sliding guide support	89
LCP WD001	113	Sliding guide support	89
LCP WD001	114	Sliding guide support	89
LCP WD001	115	Sliding guide support	89
LCP WD001	116	Fixed support	89
LCP WD001	117	Guide support	18
LCP WD001	118	Guide support	
LCP WD001	119	Fixed support	18
LCP WD001	120	Sliding support	89
LCP WD001	121	Sliding guide support	108
LCP WD001	122	Sliding guide support	108
LCP WD001	123	Guide support	108
LCP WD001	124	Sliding guide support	108
LCP WD001	125	Sliding support	220
LCP WD001	126	Fixed support	159
LCP WD001	127	Fixed support	159
LCP WD001	128	Sliding guide support	159
LCP WD001	129	Sliding support	59
LCP WD001	130	Fixed support	159
LCP WD001	131	Sliding support	159
LCP WD001	132	Sliding support	108
LCP WD001	133	Fixed support	108
LCP WD001	134	Sliding guide support	108
LCP WD001	135	Sliding guide support	108
LCP WD001	136	Sliding guide support	108
LCP WD001	137	Fixed support	25
LCP WD001	138	Fixed support	18
LCP WD001	139	Sliding guide support	108
LCP WD001	140	Sliding guide support	108
LCP WD001	141	Sliding guide support	89
LCP WD001	142	Sliding guide support	89
LCP WD001	143	Fixed support	89
LCP WD001	144	Sliding guide support	57
LCP WD001	145	Sliding support	57
LCP WD001	146	Sliding guide support	57
LCP WD001	147	Simple hanger	57
LCP WD001	148	Sliding support	57
LCP WD001	149	Sliding support	57

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LCP WD001	150	Simple hanger	57
LCP WD001	151	Sliding support	57
LCP WD001	152	Simple hanger	57
LCP WD001	153	Simple hanger	57
LCP WD001	154	Simple hanger	57
LCP WD001	155	Sliding support	57
LCP WD001	156	Simple hanger	57
LCP WD001	157	Sliding support	57
LCP WD001	158	Simple hanger	57
LCP WD001	159	Simple hanger	57
LCP WD001	160	Sliding support	57
LCP WD001	161	Sliding support	57
LCP WD001	162	Sliding support	57
LCP WD001	163	Sliding support	57
LCP WD001	164	Simple hanger	57
LCP WD001	165	Sliding support	57
LCP WD001	166	Sliding support	57
LCP WD001	167	Simple hanger	273
LCP WD001	168	Guide support	273
LCP WD001	169	Fixed support	273
LCP WD001	170	Fixed support	25
LCP WD001	171	Simple hanger	273
LCP WD001	172	Sliding guide support	89
LCP WD001	173	Simple hanger	89
LCS. WD001	1	Guide sliding support	14
LCS. WD001	2	Guide sliding support	14
LCS. WD001	3	Guide sliding support	14
LCS. WD001	4	Guide sliding support	14
LCS. WD001	5	Guide sliding support	14
LCS. WD001	6	Guide sliding support	14
LCS. WD001	7	Guide sliding support	32
LCS. WD001	8	Guide sliding support	32
LCS. WD001	9	Guide sliding support	32
LCS. WD001	10	Guide sliding support	18
LCS. WD001	11	Guide sliding support	32
LCS. WD001	12	Guide sliding support	32
LCS. WD001	13	Guide sliding support	32
LCS. WD001	14	Guide sliding support	32
LCS. WD001	15	Guide sliding support	32
LCS. WD001	16	Guide sliding support	32
LAH. WD001	1	GUIDE SLIDING SUPPORT	159
LAH. WD001	2	GUIDE SLIDING SUPPORT	159
LAH. WD001	3	SPRING HANGER	159
LAH. WD001	4	SLIDING SUPPORT	159
LAH. WD001	5	GUIDE SUPPORT	159
LAH. WD001	6	SLIDING SUPPORT	219
LAH. WD001	7	GUIDE SLIDING SUPPORT	159
LAH. WD001	8	GUIDE SLIDING SUPPORT	159
LAH. WD001	9	SPRING HANGER	159
LAH. WD001	10	SLIDING SUPPORT	159
LAH. WD001	11	GUIDE SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAH.WD001	12	GUIDE SLIDING SUPPORT	219
LAH.WD001	13	GUIDE SUPPORT	219
LAH.WD001	14	GUIDE SUPPORT	219
LAH.WD001	15	SPRING HANGER	219
LAH.WD001	16	GUIDE SUPPORT	219
LAH.WD001	17	IMMOVABLE SUPPORT	219
LAH.WD001	18	GUIDE SUPPORT	219
LAH.WD001	19	SPRING HANGER	219
LAH.WD001	20	SLIDING SUPPORT	89
LAH.WD001	21	GUIDE SLIDING SUPPORT	89
LAH.WD001	22	RIGID HANGER	89
LAH.WD001	23	RIGID HANGER	89
LAH.WD001	24	GUIDE SLIDING SUPPORT	89
LAH.WD001	25	RIGID HANGER	89
LAH.WD001	26	GUIDE SLIDING SUPPORT	89
LAH.WD001	27	RIGID HANGER	89
LAH.WD001	28	IMMOVABLE SUPPORT	89
LAH.WD001	29	GUIDE SUPPORT	89
LAH.WD001	30	GUIDE SUPPORT	89
LAH.WD001	31	GUIDE SLIDING SUPPORT	89
LAH.WD001	32	GUIDE SUPPORT	89
LAH.WD001	33	GUIDE SLIDING SUPPORT	89
LAH.WD001	34	GUIDE SLIDING SUPPORT	89
LAH.WD001	35	IMMOVABLE SUPPORT	APMAMYPA VALVES
LAH.WD001	36	IMMOVABLE SUPPORT	APMAMYPA VALVES
LAH.WD001	37	GUIDE SLIDING SUPPORT	
LAH.WD001	38	GUIDE SLIDING SUPPORT	57
LAH.WD001	39	GUIDE SLIDING SUPPORT	57
LAH.WD001	40	GUIDE SUPPORT	57
LAH.WD001	41	SPRING HANGER	57
LAH.WD001	42	SPRING HANGER	57
LAH.WD001	43	GUIDE SUPPORT	57
LAH.WD001	44	GUIDE SLIDING SUPPORT	57
LAH.WD001	45	IMMOVABLE SUPPORT	57
LAH.WD001	46	GUIDE SLIDING SUPPORT	57
LAH.WD001	47	GUIDE SLIDING SUPPORT	57
LAH.WD001	48	GUIDE SLIDING SUPPORT	57
LAH.WD001	49	IMMOVABLE SUPPORT	57
LAH.WD001	50	GUIDE SLIDING SUPPORT	57
LAH.WD001	51	GUIDE SLIDING SUPPORT	57
LAH.WD001	52	GUIDE SLIDING SUPPORT	57
LAH.WD001	53	GUIDE SLIDING SUPPORT	57
LAH.WD001	54	GUIDE SLIDING SUPPORT	57
LAH.WD001	55	GUIDE SLIDING SUPPORT	57
LAH.WD001	56	IMMOVABLE SUPPORT	57
LAH.WD001	57	SLIDING SUPPORT	57
LAH.WD001	58	GUIDE SUPPORT	57
LAH.WD001	59	IMMOVABLE SUPPORT	57
LAH.WD001	60	SLIDING SUPPORT	57
LAH.WD001	61	GUIDE SLIDING SUPPORT	57
LAH.WD001	62	GUIDE SLIDING SUPPORT	57

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAH.WD001	63	GUIDE SLIDING SUPPORT	57
LAH.WD001	64	GUIDE SLIDING SUPPORT	57
LAH.WD001	65	IMMOVABLE SUPPORT	57
LAH.WD001	66	GUIDE SLIDING SUPPORT	57
LAH.WD001	67	GUIDE SLIDING SUPPORT	57
LAH.WD001	68	GUIDE SLIDING SUPPORT	57
LAH.WD001	69	GUIDE SLIDING SUPPORT	57
LAH.WD001	70	GUIDE SLIDING SUPPORT	57
LAH.WD001	71	GUIDE SLIDING SUPPORT	57
LAH.WD001	72	GUIDE SLIDING SUPPORT	57
LAH.WD001	73	GUIDE SLIDING SUPPORT	57
LAH.WD001	74	GUIDE SLIDING SUPPORT	57
LAH.WD001	75	SPRING HANGER	57
LAH.WD001	76	IMMOVABLE SUPPORT	57
LAH.WD001	77	GUIDE SUPPORT	57
LAH.WD001	78	SPRING HANGER	57
LAH.WD001	79	GUIDE SLIDING SUPPORT	57
LAH.WD001	80	GUIDE SLIDING SUPPORT	57
LAH.WD001	81	GUIDE SLIDING SUPPORT	57
LAH.WD001	82	GUIDE SLIDING SUPPORT	57
LAH.WD001	83	GUIDE SLIDING SUPPORT	57
LAH.WD001	84	GUIDE SLIDING SUPPORT	57
LAH.WD001	85	GUIDE SLIDING SUPPORT	57
LAH.WD001	86	IMMOVABLE SUPPORT	57
LAH.WD001	87	GUIDE SLIDING SUPPORT	25
LAH.WD001	88	GUIDE SLIDING SUPPORT	25
LAH.WD001	89	SLIDING SUPPORT	25
LAH.WD001	90	GUIDE SUPPORT	25
LAH.WD001	91	GUIDE SUPPORT	25
LAH.WD001	92	GUIDE SUPPORT	25
LAH.WD001	93	GUIDE SUPPORT	25
LAH.WD001	94	IMMOVABLE SUPPORT	25
LAH.WD001	95	GUIDE SUPPORT	25
LAH.WD001	96	SPRING HANGER	25
LAH.WD001	97	GUIDE SUPPORT	25
LAH.WD001	98	GUIDE SLIDING SUPPORT	25
LAH.WD001	99	GUIDE SUPPORT	32
LAH.WD001	100	IMMOVABLE SUPPORT	32
LAH.WD001	101	GUIDE SLIDING SUPPORT	25
LAH.WD001	102	IMMOVABLE SUPPORT	APMAMYPA VALVES
LAH.WD002	1	SPRING HANGER	159
LAH.WD002	2	IMMOVABLE SUPPORT	159
LAH.WD002	3	GUIDE SLIDING SUPPORT	159
LAH.WD002	4	SLIDING SUPPORT	159
LAH.WD002	5	GUIDE SLIDING SUPPORT	159
LAH.WD002	6	SPRING HANGER	159
LAH.WD002	7	IMMOVABLE SUPPORT	159
LAH.WD002	8	SPRING HANGER	159
LAH.WD002	9	SPRING HANGER	159
LAH.WD002	10	GUIDE SLIDING SUPPORT	159
LAH.WD002	11	SPRING HANGER	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAH.WD002	12	GUIDE SLIDING SUPPORT	159
LAH.WD002	13	SPRING HANGER	159
LAH.WD002	14	SPRING HANGER	159
LAH.WD002	15	SPRING HANGER	159
LAH.WD002	16	IMMOVABLE SUPPORT	159
LAH.WD002	17	GUIDE SLIDING SUPPORT	159
LAH.WD002	18	GUIDE SLIDING SUPPORT	159
LAH.WD002	19	SPRING HANGER	159
LAH.WD002	20	GUIDE SLIDING SUPPORT	108
LAH.WD002	21	GUIDE SUPPORT	108
LAH.WD002	22	IMMOVABLE SUPPORT	108
LAH.WD002	23	GUIDE SUPPORT	89
LAH.WD002	24	GUIDE SLIDING SUPPORT	89
LAH.WD002	25	GUIDE SLIDING SUPPORT	89
LAH.WD002	26	GUIDE SUPPORT	89
LAH.WD002	27	GUIDE SUPPORT	89
LAH.WD002	28	GUIDE SLIDING SUPPORT	16
LAH.WD002	29	IMMOVABLE SUPPORT	APMAMYPA VALVES
LAJ.WD001	1	GUIDE SLIDING SUPPORT	57
LAJ.WD001	2	GUIDE SLIDING SUPPORT	57
LAJ.WD001	3	GUIDE SLIDING SUPPORT	57
LAJ.WD001	4	SLIDING SUPPORT	57
LAJ.WD001	5	GUIDE SLIDING SUPPORT	57
LAJ.WD001	6	SLIDING SUPPORT	57
LAJ.WD001	7	GUIDE SLIDING SUPPORT	57
LAJ.WD001	8	GUIDE SLIDING SUPPORT	57
LAJ.WD001	9	IMMOVABLE SUPPORT	57
LAJ.WD001	10	GUIDE SLIDING SUPPORT	57
LAJ.WD001	11	GUIDE SLIDING SUPPORT	57
LAJ.WD001	12	SLIDING SUPPORT	57
LAJ.WD001	13	GUIDE SLIDING SUPPORT	18
LAJ.WD001	14	SLIDING SUPPORT	18
LAJ.WD001	15	GUIDE SLIDING SUPPORT	18
LAJ.WD001	16	GUIDE SLIDING SUPPORT	57
LAJ.WD001	17	IMMOVABLE SUPPORT	57
LAJ.WD001	18	GUIDE SLIDING SUPPORT	57
LAJ.WD001	19	GUIDE SLIDING SUPPORT	57
LAJ.WD001	20	SLIDING SUPPORT	57
LAJ.WD001	21	GUIDE SLIDING SUPPORT	57
LAJ.WD001	22	SLIDING SUPPORT	57
LAJ.WD001	23	GUIDE SLIDING SUPPORT	57
LAJ.WD001	24	GUIDE SLIDING SUPPORT	57
LAJ.WD001	25	SLIDING SUPPORT	57
LAJ.WD001	26	SLIDING SUPPORT	57
LAJ.WD001	27	GUIDE SLIDING SUPPORT	32
LAJ.WD001	28	SLIDING SUPPORT	18
LAB.WD002	1	GUIDE SUPPORT	530
LAB.WD002	2	SPRING HANGER	530
LAB.WD002	3	SPRING HANGER	530
LAB.WD002	4	SPRING HANGER	530
LAB.WD002	5	SPRING SUPPORT	530

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB.WD002	6	SLIDING SUPPORT	530
LAB.WD002	7	SPRING HANGER	530
LAB.WD002	8	SLIDING SUPPORT	530
LAB.WD002	9	SLIDING SUPPORT	530
LAB.WD002	10	SPRING HANGER	530
LAB.WD002	11	GUIDE SLIDING SUPPORT	530
LAB.WD002	12	GUIDE SLIDING SUPPORT	530
LAB.WD002	13	SPRING HANGER	530
LAB.WD002	14	GUIDE SUPPORT	530
LAB.WD002	15	SPRING HANGER	530
LAB.WD002	16	SPRING HANGER	530
LAB.WD002	17	GUIDE SUPPORT	530
LAB.WD002	18	SPRING HANGER	530
LAB.WD002	19	GUIDE SLIDING SUPPORT	530
LAB.WD002	20	IMMOVABLE SUPPORT	530
LAB.WD002	21	GUIDE SLIDING SUPPORT	426
LAB.WD002	22	IMMOVABLE SUPPORT	426
LAB.WD002	23	GUIDE SUPPORT	530
LAB.WD002	24	SPRING HANGER	530
LAB.WD002	25	GUIDE SUPPORT	530
LAB.WD002	26	SPRING SUPPORT	530
LAB.WD002	27	GUIDE SUPPORT	530
LAB.WD002	28	SPRING HANGER	530
LAB.WD002	29	SPRING HANGER	530
LAB.WD002	30	GUIDE SUPPORT	530
LAB.WD002	31	SPRING HANGER	530
LAB.WD002	32	SPRING HANGER	530
LAB.WD002	33	SLIDING SUPPORT	530
LAB.WD002	34	SPRING HANGER	530
LAB.WD002	35	SLIDING SUPPORT	530
LAB.WD002	36	SLIDING SUPPORT	530
LAB.WD002	37	SPRING HANGER	530
LAB.WD002	38	GUIDE SUPPORT	530
LAB.WD002	39	GUIDE SLIDING SUPPORT	530
LAB.WD002	40	SPRING HANGER	530
LAB.WD002	41	SPRING HANGER	530
LAB.WD002	42	GUIDE SUPPORT	530
LAB.WD002	43	SPRING HANGER	530
LAB.WD002	44	SPRING HANGER	530
LAB.WD002	45	SPRING HANGER	530
LAB.WD002	46	SLIDING SUPPORT	530
LAB.WD002	47	IMMOVABLE SUPPORT	530
LAB.WD002	48	GUIDE SLIDING SUPPORT	426
LAB.WD002	49	IMMOVABLE SUPPORT	426
LAB.WD002	50	SPRING HANGER	325
LAB.WD002	51	GUIDE SLIDING SUPPORT	325
LAB.WD002	52	SLIDING SUPPORT	159
LAB.WD002	53	GUIDE SUPPORT	133
LAB.WD002	54	IMMOVABLE SUPPORT	325
LAB.WD002	55	SLIDING SUPPORT	159
LAB.WD002	56	GUIDE SLIDING SUPPORT	325

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB. WD002	57	SPRING HANGER	325
LAB. WD002	58	GUIDE SUPPORT	325
LAB. WD002	59	SPRING HANGER	325
LAB. WD002	60	IMMOVABLE SUPPORT	325
LAB. WD002	61	SLIDING SUPPORT	159
LAB. WD002	62	GUIDE SUPPORT	325
LAB. WD002	63	SLIDING SUPPORT	159
LAB. WD002	64	GUIDE SUPPORT	133
LAB. WD002	65	GUIDE SLIDING SUPPORT	325
LAB. WD002	66	SPRING HANGER	325
LAB. WD002	67	SPRING HANGER	325
LAB. WD002	68	SPRING HANGER	325
LAB. WD002	69	GUIDE SUPPORT	325
LAB. WD002	70	IMMOVABLE SUPPORT	325
LAB. WD002	71	SPRING HANGER	325
LAB. WD002	72	GUIDE SUPPORT	273
LAB. WD002	73	SPRING HANGER	273
LAB. WD002	74	IMMOVABLE SUPPORT	273
LAB. WD002	75	SLIDING SUPPORT	273
LAB. WD002	76	SPRING HANGER	273
LAB. WD002	77	SPRING HANGER	273
LAB. WD002	78	SPRING HANGER	273
LAB. WD002	79	SLIDING SUPPORT	273
LAB. WD002	80	SLIDING SUPPORT	273
LAB. WD002	81	IMMOVABLE SUPPORT	273
LAB. WD002	82	SPRING HANGER	219
LAB. WD002	83	GUIDE SUPPORT	219
LAB. WD002	84	GUIDE SLIDING SUPPORT	219
LAB. WD002	85	IMMOVABLE SUPPORT	219
LAB. WD002	86	GUIDE SLIDING SUPPORT	219
LAB. WD002	87	GUIDE SLIDING SUPPORT	32
LAB. WD002	88	IMMOVABLE SUPPORT	32
LAB. WD002	89	SLIDING SUPPORT	32
LAB. WD002	90	GUIDE SUPPORT	32
LAB. WD002	91	GUIDE SUPPORT	32
LAB. WD002	92	SLIDING SUPPORT	32
LAB. WD002	93	GUIDE SLIDING SUPPORT	32
LAB. WD002	94	IMMOVABLE SUPPORT	32
LAB. WD002	95	SLIDING SUPPORT	32
LAB. WD002	96	GUIDE SLIDING SUPPORT	38
LAB. WD002	97	IMMOVABLE SUPPORT	38
LAB. WD002	98	GUIDE SUPPORT	38
LAB. WD002	99	GUIDE SLIDING SUPPORT	38
LAB. WD002	100	IMMOVABLE SUPPORT	38
LAB. WD002	101	SLIDING SUPPORT	32
LAB. WD002	102	GUIDE SUPPORT	32
LAB. WD002	103	SLIDING SUPPORT	32
LAB. WD002	104	IMMOVABLE SUPPORT	32
LAB. WD002	105	GUIDE SLIDING SUPPORT	32
LAB. WD002	106	IMMOVABLE SUPPORT	32
LAB. WD002	107	GUIDE SUPPORT	32

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB. WD002	108	GUIDE SUPPORT	32
LAB. WD002	109	GUIDE SUPPORT	32
LAB. WD002	110	GUIDE SUPPORT	32
LAB. WD002	111	GUIDE SUPPORT	32
LAB. WD002	112	GUIDE SLIDING SUPPORT	32
LAB. WD002	113	IMMOVABLE SUPPORT	32
LAB. WD002	114	SLIDING SUPPORT	38
LAB. WD002	115	IMMOVABLE SUPPORT	38
LAB. WD002	116	GUIDE SLIDING SUPPORT	32
LAB. WD002	117	GUIDE SUPPORT	32
LAB. WD002	118	IMMOVABLE SUPPORT	32
LAB. WD002	119	GUIDE SLIDING SUPPORT	32
LAB. WD002	120	IMMOVABLE SUPPORT	32
LAB. WD002	121	SLIDING SUPPORT	38
LAB. WD002	122	IMMOVABLE SUPPORT	38
LAB. WD002	123	GUIDE SLIDING SUPPORT	38
LAB. WD002	124	IMMOVABLE SUPPORT	38
LAB. WD002	125	IMMOVABLE SUPPORT	32
LAB. WD002	126	GUIDE SLIDING SUPPORT	57
LAB. WD002	127	SLIDING SUPPORT	57
LAB. WD002	128	SLIDING SUPPORT	426
LAB. WD002	129	SPRING HANGER	426
LAB. WD002	130	SPRING HANGER	426
LAB. WD002	131	GUIDE SLIDING SUPPORT	426
LAB. WD002	132	SLIDING SUPPORT	426
LAB. WD002	133	SLIDING SUPPORT	426
LAB. WD002	134	SPRING HANGER	219
LAB. WD002	135	SPRING HANGER	219
LAB. WD002	136	GUIDE SUPPORT	219
LAB. WD002	137	IMMOVABLE SUPPORT	219
LAB. WD002	138	SPRING HANGER	219
LAB. WD002	139	SPRING HANGER	219
LAB. WD002	140	GUIDE SUPPORT	245
LAB. WD002	141	SPRING HANGER	426
LAB. WD002	142	SPRING HANGER	426
LAB. WD002	143	SLIDING SUPPORT	426
LAB. WD002	144	SLIDING SUPPORT	426
LAB. WD002	145	SLIDING SUPPORT	426
LAB. WD002	146	SPRING HANGER	426
LAB. WD002	147	SPRING HANGER	426
LAB. WD002	148	SPRING HANGER	219
LAB. WD002	149	GUIDE SUPPORT	219
LAB. WD002	150	IMMOVABLE SUPPORT	219
LAB. WD002	151	SPRING HANGER	219
LAB. WD002	152	SPRING HANGER	219
LAB. WD002	153	GUIDE SUPPORT	245
LAB. WD002	154	GUIDE SUPPORT	32
LAB. WD002	155	IMMOVABLE SUPPORT	32
LAB. WD002	156	GUIDE SUPPORT	32
LAB. WD002	157	SLIDING SUPPORT	32
LAB. WD002	158	IMMOVABLE SUPPORT	32

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB. WD002	159	GUIDE SLIDING SUPPORT	16
LAB. WD002	160	GUIDE SLIDING SUPPORT	16
LAB. WD002	161	GUIDE SLIDING SUPPORT	16
LAB. WD002	162	IMMOVABLE SUPPORT	16
LAB. WD002	163	GUIDE SUPPORT	32
LAB. WD002	164	IMMOVABLE SUPPORT	32
LAB. WD002	165	GUIDE SUPPORT	32
LAB. WD002	166	IMMOVABLE SUPPORT	32
LAB. WD002	167	GUIDE SLIDING SUPPORT	32
LAB. WD002	168	IMMOVABLE SUPPORT	32
LAB. WD002	171	GUIDE SLIDING SUPPORT	16
LAB. WD002	172	GUIDE SLIDING SUPPORT	16
LAB. WD002	173	GUIDE SLIDING SUPPORT	16
LAB. WD002	174	IMMOVABLE SUPPORT	16
LAB. WD002	175	IMMOVABLE SUPPORT	530
LAB. WD002	176	GUIDE SLIDING SUPPORT	530
LAB. WD002	177	SPRING HANGER	530
LAB. WD002	178	SPRING HANGER	530
LAB. WD002	179	GUIDE SUPPORT	530
LAB. WD002	180	SPRING HANGER	530
LAB. WD002	182	IMMOVABLE SUPPORT	530
LAB. WD002	183	GUIDE SLIDING SUPPORT	530
LAB. WD002	184	SPRING HANGER	530
LAB. WD002	185	SPRING HANGER	530
LAB. WD002	186	SPRING HANGER	530
LAB. WD002	187	GUIDE SUPPORT	426
LAB. WD002	188	SPRING HANGER	530
LAB. WD002	190	GUIDE SLIDING SUPPORT	426
LAB. WD002	191	SLIDING SUPPORT	426
LAB. WD002	192	SLIDING SUPPORT	426
LAB. WD002	193	SLIDING SUPPORT	426
LAB. WD002	194	SPRING HANGER	426
LAB. WD002	195	GUIDE SUPPORT	426
LAB. WD002	196	IMMOVABLE SUPPORT	426
LAB. WD002	197	SPRING HANGER	426
LAB. WD002	198	SPRING HANGER	426
LAB. WD002	199	SLIDING SUPPORT	108
LAB. WD002	200	SLIDING SUPPORT	108
LAB. WD002	201	IMMOVABLE SUPPORT	108
LAB. WD002	202	GUIDE SLIDING SUPPORT	108
LAB. WD002	203	SPRING HANGER	426
LAB. WD002	204	SPRING HANGER	426
LAB. WD002	205	IMMOVABLE SUPPORT	426
LAB. WD002	206	SPRING HANGER	426
LAB. WD002	207	SPRING HANGER	426
LAB. WD002	208	SLIDING SUPPORT	108
LAB. WD002	209	SLIDING SUPPORT	108
LAB. WD002	210	IMMOVABLE SUPPORT	108
LAB. WD002	211	GUIDE SLIDING SUPPORT	108
LAB. WD002	212	SPRING HANGER	426
LAB. WD002	213	GUIDE SUPPORT	426

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB. WD002	214	IMMOVABLE SUPPORT	426
LAB. WD002	215	SPRING HANGER	426
LAB. WD002	216	GUIDE SUPPORT	426
LAB. WD002	217	SPRING HANGER	426
LAB. WD002	218	GUIDE SLIDING SUPPORT	108
LAB. WD002	219	SLIDING SUPPORT	108
LAB. WD002	220	IMMOVABLE SUPPORT	108
LAB. WD002	221	GUIDE SLIDING SUPPORT	108
LAB. WD002	222	SPRING HANGER	426
LAB. WD002	223	GUIDE SUPPORT	426
LAB. WD002	224	IMMOVABLE SUPPORT	426
LAB. WD002	225	SPRING HANGER	426
LAB. WD002	226	GUIDE SUPPORT	426
LAB. WD002	227	SPRING HANGER	426
LAB. WD002	228	SPRING HANGER	426
LAB. WD002	229	GUIDE SLIDING SUPPORT	108
LAB. WD002	230	SLIDING SUPPORT	108
LAB. WD002	231	IMMOVABLE SUPPORT	108
LAB. WD002	232	GUIDE SLIDING SUPPORT	108
LAB. WD002	233	IMMOVABLE SUPPORT	325
LAB. WD002	234	GUIDE SUPPORT	325
LAB. WD002	235	SPRING HANGER	325
LAB. WD002	236	GUIDE SUPPORT	325
LAB. WD002	237	IMMOVABLE SUPPORT	325
LAB. WD002	238	SPRING HANGER	325
LAB. WD002	240	SPRING HANGER	32
LAB. WD002	241	SLIDING SUPPORT	32
LAB. WD002	242	GUIDE SLIDING SUPPORT	32
LAB. WD002	243	SLIDING SUPPORT	32
LAB. WD002	244	SLIDING SUPPORT	38
LAB. WD002	245	IMMOVABLE SUPPORT	38
LAB. WD002	246	SLIDING SUPPORT	38
LAB. WD002	247	IMMOVABLE SUPPORT	38
LAB. WD002	248	SLIDING SUPPORT	38
LAB. WD002	249	IMMOVABLE SUPPORT	38
LAB. WD002	250	SLIDING SUPPORT	38
LAB. WD002	251	IMMOVABLE SUPPORT	38
LAB. WD002	252	SPRING HANGER	273
LAB. WD002	253	GUIDE SUPPORT	426
LAB. WD002	254	SPRING HANGER	426
LDB WD001	1	GUIDE SLIDING SUPPORT	273
LDB WD001	2	SLIDING SUPPORT	273
LDB WD001	3	GUIDE SLIDING SUPPORT	273
LDB WD001	4	SLIDING SUPPORT	273
LDB WD001	5	GUIDE SLIDING SUPPORT	273
LDB WD001	6	SLIDING SUPPORT	273
LDB WD001	7	SLIDING SUPPORT	273
LDB WD001	8	SLIDING SUPPORT	273
LDB WD001	9	GUIDE SLIDING SUPPORT	273
LDB WD001	10	SLIDING SUPPORT	273
LDB WD001	11	GUIDE SLIDING SUPPORT	273

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDB WD001	12	SLIDING SUPPORT	273
LDB WD001	13	FIXED SUPPORT	273
LDB WD001	14	RIGID HANGER	273
LDB WD001	15	GUIDE SLIDING SUPPORT	273
LDB WD001	16	FIXED SUPPORT	159
LDB WD001	17	SLIDING SUPPORT	220
LDB WD001	18	SLIDING SUPPORT	108
LDB WD001	19	GUIDE SLIDING SUPPORT	159
LDB WD001	20	GUIDE SLIDING SUPPORT	159
LDB WD001	21	GUIDE SLIDING SUPPORT	159
LDB WD001	22	GUIDE SLIDING SUPPORT	159
LDB WD001	23	GUIDE SLIDING SUPPORT	159
LDB WD001	24	GUIDE SLIDING SUPPORT	159
LDB WD001	25	SLIDING SUPPORT	159
LDB WD001	26	GUIDE SLIDING SUPPORT	108
LDB WD001	27	SLIDING SUPPORT	159
LDB WD001	28	SLIDING SUPPORT	159
LDB WD001	29	SLIDING SUPPORT	108
LDB WD001	30	FIXED SUPPORT	159
LDB WD001	31	GUIDE SLIDING SUPPORT	159
LDB WD001	32	GUIDE SLIDING SUPPORT	159
LDB WD001	33	RIGID HANGER	159
LDB WD001	34	FIXED SUPPORT	159
LDB WD001	35	SLIDING SUPPORT	108
LDB WD001	36	GUIDE SLIDING SUPPORT	159
LDB WD001	37	SLIDING SUPPORT	159
LDB WD001	38	SLIDING SUPPORT	159
LDB WD001	39	SLIDING SUPPORT	159
LDB WD001	40	SLIDING SUPPORT	159
LDB WD001	41	GUIDE SLIDING SUPPORT	159
LDB WD001	42	SLIDING SUPPORT	159
LDB WD001	43	SLIDING SUPPORT	159
LDB WD001	44	GUIDE SLIDING SUPPORT	159
LDB WD001	45	GUIDE SLIDING SUPPORT	159
LDB WD001	46	SLIDING SUPPORT	159
LDB WD001	47	SLIDING SUPPORT	159
LDB WD001	48	FIXED SUPPORT	220
LDB WD001	49	GUIDE SLIDING SUPPORT	220
LDB WD001	50	SLIDING SUPPORT	220
LDB WD001	51	GUIDE SLIDING SUPPORT	220
LDB WD001	52	SLIDING SUPPORT	220
LDB WD001	53	SLIDING SUPPORT	220
LDB WD001	54	SLIDING SUPPORT	220
LDB WD001	55	GUIDE SLIDING SUPPORT	220
LDB WD001	56	SLIDING SUPPORT	220
LDB WD001	57	SLIDING SUPPORT	220
LDB WD001	58	SLIDING SUPPORT	220
LDB WD001	59	GUIDE SLIDING SUPPORT	220
LDB WD001	60	SLIDING SUPPORT	220
LDB WD001	61	GUIDE SLIDING SUPPORT	220
LDB WD001	62	SLIDING SUPPORT	220

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDB WD001	63	FIXED SUPPORT	220
LDB WD001	64	GUIDE SLIDING SUPPORT	220
LDB WD001	65	SLIDING SUPPORT	220
LDB WD001	66	GUIDE SLIDING SUPPORT	220
LDB WD001	67	SLIDING SUPPORT	220
LDB WD001	68	GUIDE SLIDING SUPPORT	220
LDB WD001	69	GUIDE SLIDING SUPPORT	108
LDB WD001	70	SLIDING SUPPORT	89
LDB WD001	71	SLIDING SUPPORT	108
LDB WD001	72	SLIDING SUPPORT	89
LDB WD001	73	SLIDING SUPPORT	108
LDB WD001	74	GUIDE SLIDING SUPPORT	273
LDB WD001	75	GUIDE SLIDING SUPPORT	273
LDB WD001	76	GUIDE SLIDING SUPPORT	156
LDB WD001	77	SLIDING SUPPORT	108
LDB WD001	78	SLIDING SUPPORT	89
LDB WD001	79	GUIDE SLIDING SUPPORT	89
LDB WD001	80	FIXED SUPPORT	89
LDB WD001	81	SLIDING SUPPORT	89
LDB WD001	82	GUIDE SLIDING SUPPORT	89
LDB WD001	83	SLIDING SUPPORT	89
LDB WD001	84	SLIDING SUPPORT	89
LDB WD001	85	GUIDE SLIDING SUPPORT	89
LDB WD001	86	SLIDING SUPPORT	89
LDB WD001	87	SLIDING SUPPORT	89
LDB WD001	88	SLIDING SUPPORT	89
LDB WD001	89	GUIDE SLIDING SUPPORT	89
LDB WD001	90	SLIDING SUPPORT	89
LDB WD001	91	SLIDING SUPPORT	89
LDB WD001	92	GUIDE SLIDING SUPPORT	89
LDB WD001	93	SLIDING SUPPORT	108
LDB WD001	94	GUIDE SLIDING SUPPORT	108
LDB WD001	95	SLIDING SUPPORT	108
LDB WD001	96	SLIDING SUPPORT	108
LDB WD001	97	SLIDING SUPPORT	108
LDB WD001	98	SLIDING SUPPORT	108
LDB WD001	99	GUIDE SLIDING SUPPORT	108
LDB WD001	100	FIXED SUPPORT	108
LDB WD001	101	GUIDE SLIDING SUPPORT	108
LDB WD001	102	SLIDING SUPPORT	108
LDB WD001	103	SLIDING SUPPORT	108
LDB WD001	104	GUIDE SLIDING SUPPORT	108
LDB WD001	105	SLIDING SUPPORT	108
LDB WD001	106	SLIDING SUPPORT	108
LDB WD001	107	GUIDE SLIDING SUPPORT	108
LDB WD001	108	SLIDING SUPPORT	108
LDB WD001	109	SLIDING SUPPORT	108
LDB WD001	110	SLIDING SUPPORT	108
LDB WD001	111	GUIDE SLIDING SUPPORT	108
LDB WD001	112	FIXED SUPPORT	108
LDB WD001	113	GUIDE SLIDING SUPPORT	108

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDB WD001	114	SLIDING SUPPORT	108
LDB WD001	115	GUIDE SLIDING SUPPORT	108
LDB WD001	116	FIXED SUPPORT	108
LDB WD001	117	GUIDE SLIDING SUPPORT	108
LDB WD001	118	SLIDING SUPPORT	108
LDB WD001	119	SLIDING SUPPORT	108
LDB WD001	120	GUIDE SLIDING SUPPORT	108
LDB WD001	121	SLIDING SUPPORT	108
LDB WD001	122	SLIDING SUPPORT	108
LDB WD001	123	GUIDE SLIDING SUPPORT	108
LDB WD001	124	SLIDING SUPPORT	108
LDB WD001	125	SLIDING SUPPORT	108
LDB WD001	126	SLIDING SUPPORT	108
LDB WD001	127	GUIDE SLIDING SUPPORT	108
LDB WD001	128	SLIDING SUPPORT	108
LDB WD001	129	GUIDE SLIDING SUPPORT	108
LDB WD001	130	SLIDING SUPPORT	108
LDB WD001	131	GUIDE SLIDING SUPPORT	108
LDB WD001	132	SLIDING SUPPORT	108
LDB WD001	133	GUIDE SLIDING SUPPORT	108
LDB WD001	134	SLIDING SUPPORT	89
LDB WD001	135	SLIDING SUPPORT	89
LDB WD001	136	GUIDE SLIDING SUPPORT	89
LDB WD001	137	FIXED SUPPORT	89
LDB WD001	138	GUIDE SLIDING SUPPORT	89
LDB WD001	139	SLIDING SUPPORT	89
LDB WD001	140	SLIDING SUPPORT	89
LDB WD001	141	GUIDE SLIDING SUPPORT	89
LDB WD001	142	SLIDING SUPPORT	89
LDB WD001	143	SLIDING SUPPORT	89
LDB WD001	144	SLIDING SUPPORT	89
LDB WD001	145	GUIDE SLIDING SUPPORT	89
LDB WD001	146	SLIDING SUPPORT	89
LDB WD001	147	SLIDING SUPPORT	89
LDB WD001	148	GUIDE SLIDING SUPPORT	89
LDB WD001	149	SLIDING SUPPORT	108
LDB WD001	150	GUIDE SLIDING SUPPORT	108
LDF WD001	1	FIXED SUPPORT	820
LDF WD001	2	GUIDE SLIDING SUPPORT	820
LDF WD001	3	RIGID HANGER	820
LDF WD001	4	FIXED SUPPORT	820
LDF WD001	5	RIGID HANGER	820
LDF WD001	6	RIGID HANGER	820
LDF WD001	7	FIXED SUPPORT	820
LDF WD001	8	RIGID HANGER	820
LDF WD001	9	GUIDE SLIDING SUPPORT	820
LDF WD001	10	FIXED SUPPORT	820
LDF WD001	11	GUIDE SLIDING SUPPORT	630
LDF WD001	12	GUIDE SLIDING SUPPORT	426
LDF WD001	13	GUIDE SLIDING SUPPORT	820
LDF WD001	14	SLIDING SUPPORT	426

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDF WD001	15	SLIDING SUPPORT	426
LDF WD001	16	SLIDING SUPPORT	426
LDF WD001	17	SLIDING SUPPORT	426
LDF WD001	18	SLIDING SUPPORT	426
LDF WD001	19	SLIDING SUPPORT	630
LDF WD001	20	SLIDING SUPPORT	630
LDF WD001	21	SLIDING SUPPORT	426
LDF WD001	22	SLIDING SUPPORT	630
LDF WD001	23	GUIDE SLIDING SUPPORT	159
LDF WD001	24	FIXED SUPPORT	820
LDF WD001	25	GUIDE SLIDING SUPPORT	820
LDF WD001	26	GUIDE SLIDING SUPPORT	630
LDF WD001	27	GUIDE SLIDING SUPPORT	630
LDF WD001	28	GUIDE SLIDING SUPPORT	426
LDF WD001	29	SLIDING SUPPORT	426
LDF WD001	30	GUIDE SLIDING SUPPORT	426
LDF WD001	31	SLIDING SUPPORT	426
LDF WD001	32	FIXED SUPPORT	630
LDF WD001	33	SLIDING SUPPORT	820
LDF WD001	34	GUIDE SLIDING SUPPORT	820
LDF WD001	35	GUIDE SLIDING SUPPORT	820
LDF WD001	36	GUIDE SLIDING SUPPORT	820
LDF WD001	37	FIXED SUPPORT	820
LDF WD001	38	SLIDING SUPPORT	820
LDF WD001	39	GUIDE SLIDING SUPPORT	820
LDF WD001	40	FIXED SUPPORT	820
LDF WD001	41	SLIDING SUPPORT	159
LDF WD001	42	SLIDING SUPPORT	159
LDF WD001	43	GUIDE SLIDING SUPPORT	159
LDF WD001	44	GUIDE SLIDING SUPPORT	159
LDF WD001	45	GUIDE SLIDING SUPPORT	159
LDF WD001	46	FIXED SUPPORT	159
LDF WD001	47	SLIDING SUPPORT	159
LDF WD001	48	GUIDE SLIDING SUPPORT	159
LDF WD001	49	SLIDING SUPPORT	426
LDF WD001	50	GUIDE SLIDING SUPPORT	426
LDF WD001	51	SLIDING SUPPORT	426
LDF WD001	52	GUIDE SLIDING SUPPORT	426
LDF WD001	53	FIXED SUPPORT	426
LDF WD001	54	SLIDING SUPPORT	426
LDF WD001	55	FIXED SUPPORT	426
LDF WD001	56	SLIDING SUPPORT	426
LDF WD001	57	FIXED SUPPORT	426
LDF WD001	58	GUIDE SLIDING SUPPORT	426
LDF WD001	59	FIXED SUPPORT	426
LDF WD001	60	GUIDE SLIDING SUPPORT	426
LDF WD001	61	FIXED SUPPORT	426
LDF WD001	62	GUIDE SLIDING SUPPORT	426
LDF WD001	63	FIXED SUPPORT	426
LDF WD001	64	GUIDE SLIDING SUPPORT	426
LDF WD001	65	FIXED SUPPORT	426

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDF WD001	66	SLIDING SUPPORT	426
LDF WD001	67	SLIDING SUPPORT	426
LDF WD001	68	SLIDING SUPPORT	426
LDF WD001	69	SLIDING SUPPORT	108
LDF WD001	70	SLIDING SUPPORT	159
LDF WD001	71	SLIDING SUPPORT	159
LDF WD001	72	SLIDING SUPPORT	159
LDF WD001	73	SLIDING SUPPORT	159
LDF WD001	74	SLIDING SUPPORT	159
LDF WD001	75	SLIDING SUPPORT	377
LDF WD001	76	SLIDING SUPPORT	159
LDF WD001	77	SLIDING SUPPORT	377
LDF WD001	78	SLIDING SUPPORT	159
LDF WD001	79	SLIDING SUPPORT	377
LDF WD001	80	SLIDING SUPPORT	159
LDF WD001	81	SLIDING SUPPORT	377
LDF WD001	82	SLIDING SUPPORT	159
LDF WD001	83	SLIDING SUPPORT	377
LDF WD001	84	SLIDING SUPPORT	377
LDF WD001	85	SLIDING SUPPORT	377
LDF WD001	86	SLIDING SUPPORT	377
LDF WD001	87	SLIDING SUPPORT	377
LDF WD001	88	SLIDING SUPPORT	377
LDF WD001	89	SLIDING SUPPORT	159
LDF WD001	90	SLIDING SUPPORT	108
LDF WD001	91	SLIDING SUPPORT	108
LDF WD001	92	SLIDING SUPPORT	108
LDF WD001	93	SLIDING SUPPORT	108
LDF WD001	94	SLIDING SUPPORT	108
LDF WD001	95	FIXED SUPPORT	108
LDF WD001	96	SLIDING SUPPORT	108
LDF WD001	97	SLIDING SUPPORT	108
LDF WD001	98	SLIDING SUPPORT	108
LDF WD001	99	SLIDING SUPPORT	159
LDF WD001	100	SLIDING SUPPORT	159
LDF WD001	101	SLIDING SUPPORT	159
LDF WD001	102	SLIDING SUPPORT	159
LDF WD001	103	SLIDING SUPPORT	159
LDF WD001	104	GUIDE SLIDING SUPPORT	159
LDF WD001	105	GUIDE SLIDING SUPPORT	159
LDF WD001	106	SLIDING SUPPORT	159
LDF WD001	107	SLIDING SUPPORT	159
LDF WD001	108	SLIDING SUPPORT	159
LDF WD001	109	SLIDING SUPPORT	159
LDF WD001	110	FIXED SUPPORT	159
LDF WD001	111	SLIDING SUPPORT	159
LDF WD001	112	SLIDING SUPPORT	159
LDF WD001	113	SLIDING SUPPORT	159
LDF WD001	114	SLIDING SUPPORT	159
LDF WD001	115	GUIDE SLIDING SUPPORT	159
LDF WD001	116	SLIDING SUPPORT	108

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDF WD001	117	SLIDING SUPPORT	159
LDF WD001	118	SLIDING SUPPORT	159
LDF WD001	119	SLIDING SUPPORT	159
LDF WD001	120	SLIDING SUPPORT	159
LDF WD001	121	FIXED SUPPORT	108
LDF WD001	122	SLIDING SUPPORT	159
LDF WD001	123	SLIDING SUPPORT	159
LDF WD001	124	GUIDE SLIDING SUPPORT	159
LDF WD001	125	SLIDING SUPPORT	159
LDF WD001	126	FIXED SUPPORT	159
LDF WD001	127	SLIDING SUPPORT	159
LDF WD001	128	GUIDE SLIDING SUPPORT	159
LDF WD001	129	SLIDING SUPPORT	159
LDF WD001	130	FIXED SUPPORT	159
LDF WD001	131	SLIDING SUPPORT	159
LDF WD001	132	SLIDING SUPPORT	159
LDF WD001	133	SLIDING SUPPORT	159
LDF WD001	134	FIXED SUPPORT	159
LDF WD001	135	SLIDING SUPPORT	159
LDF WD001	136	SLIDING SUPPORT	159
LDF WD001	137	SLIDING SUPPORT	159
LDF WD001	138	SLIDING SUPPORT	159
LDF WD001	139	SLIDING SUPPORT	159
LDF WD001	140	FIXED SUPPORT	159
LDF WD001	141	SLIDING SUPPORT	159
LDF WD001	142	RIGID HANGER	159
LDF WD001	143	FIXED SUPPORT	108
LDF WD001	144	SLIDING SUPPORT	159
LDF WD001	145	SLIDING SUPPORT	159
LDF WD001	146	SLIDING SUPPORT	159
LDF WD001	147	SLIDING SUPPORT	159
LDF WD001	148	SLIDING SUPPORT	159
LDF WD001	149	SLIDING SUPPORT	159
LDF WD001	150	SLIDING SUPPORT	159
LDF WD001	151	SLIDING SUPPORT	159
LDF WD001	152	SLIDING SUPPORT	159
LDF WD001	153	FIXED SUPPORT	159
LDF WD001	154	SLIDING SUPPORT	159
LDF WD001	155	SLIDING SUPPORT	159
LDF WD001	156	SLIDING SUPPORT	159
LDF WD001	157	SLIDING SUPPORT	159
LDF WD001	158	SLIDING SUPPORT	159
LDF WD001	159	SLIDING SUPPORT	159
LDF WD001	160	SLIDING SUPPORT	159
LDF WD001	161	FIXED SUPPORT	159
LDF WD001	162	SLIDING SUPPORT	159
LDF WD001	163	SLIDING SUPPORT	159
LDF WD001	164	GUIDE SLIDING SUPPORT	159
LDF WD001	165	SLIDING SUPPORT	159
LDF WD001	166	SLIDING SUPPORT	159
LDF WD001	167	GUIDE SLIDING SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDF WD001	168	SLIDING SUPPORT	159
LDF WD001	169	SLIDING SUPPORT	159
LDF WD001	170	SLIDING SUPPORT	159
LDF WD001	171	SLIDING SUPPORT	159
LDF WD001	172	SLIDING SUPPORT	159
LDF WD001	173	SLIDING SUPPORT	108
LDF WD001	174	FIXED SUPPORT	108
LDF WD001	175	SLIDING SUPPORT	108
LDF WD001	176	SLIDING SUPPORT	108
LDF WD001	177	SLIDING SUPPORT	108
LDF WD001	178	SLIDING SUPPORT	108
LDF WD001	179	SLIDING SUPPORT	108
LDF WD001	180	SLIDING SUPPORT	108
LDF WD001	181	SLIDING SUPPORT	108
LDF WD001	182	GUIDE SLIDING SUPPORT	108
LDF WD001	183	SLIDING SUPPORT	108
LDF WD001	184	SLIDING SUPPORT	108
LDF WD001	185	SLIDING SUPPORT	108
LDF WD001	186	SLIDING SUPPORT	108
LDF WD001	187	SLIDING SUPPORT	108
LDF WD001	188	SLIDING SUPPORT	108
LDF WD001	189	SLIDING SUPPORT	108
LDF WD001	190	SLIDING SUPPORT	108
LDF WD001	191	SLIDING SUPPORT	108
LDF WD001	192	SLIDING SUPPORT	108
LDF WD001	193	GUIDE SLIDING SUPPORT	108
LDF WD001	194	GUIDE SLIDING SUPPORT	108
LDF WD001	195	GUIDE SLIDING SUPPORT	108
LDF WD001	196	FIXED SUPPORT	108
LDF WD001	197	GUIDE SLIDING SUPPORT	108
LDF WD001	198	GUIDE SLIDING SUPPORT	108
LDF WD001	199	GUIDE SLIDING SUPPORT	108
LDF WD001	200	GUIDE SLIDING SUPPORT	108
LDF WD001	201	SLIDING SUPPORT	108
LDF WD001	202	FIXED SUPPORT	108
LDF WD001	203	SLIDING SUPPORT	57
LDF WD001	204	SLIDING SUPPORT	57
LDF WD001	205	SLIDING SUPPORT	108
LDF WD001	206	SLIDING SUPPORT	108
LDF WD001	207	SLIDING SUPPORT	159
LDF WD001	208	SLIDING SUPPORT	159
LDF WD001	209	GUIDE SLIDING SUPPORT	159
LDF WD001	210	GUIDE SLIDING SUPPORT	159
LDF WD001	211	SLIDING SUPPORT	159
LDF WD001	212	GUIDE SLIDING SUPPORT	159
LDF WD001	213	FIXED SUPPORT	159
LDF WD001	214	FIXED SUPPORT	159
LDF WD001	215	FIXED SUPPORT	159
LDF WD001	216	GUIDE SLIDING SUPPORT	159
LDF WD001	217	SLIDING SUPPORT	159
LDF WD001	218	FIXED SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDF WD001	219	FIXED SUPPORT	159
LDF WD001	220	BLOCK HANGER	159
LDF WD001	221	FIXED SUPPORT	159
LDF WD001	222	SLIDING SUPPORT	159
LDF WD001	223	GUIDE SLIDING SUPPORT	159
LDF WD001	224	SLIDING SUPPORT	159
LDF WD001	225	GUIDE SLIDING SUPPORT	159
LDF WD001	226	SLIDING SUPPORT	159
LDF WD001	227	SLIDING SUPPORT	159
LDF WD001	228	GUIDE SLIDING SUPPORT	159
LDF WD001	229	SLIDING SUPPORT	159
LDF WD001	230	SLIDING SUPPORT	159
LDF WD001	231	GUIDE SLIDING SUPPORT	159
LDF WD001	232	FIXED SUPPORT	159
LDF WD001	233	SLIDING SUPPORT	159
LDF WD001	234	SLIDING SUPPORT	159
LDF WD001	235	SLIDING SUPPORT	159
LDF WD001	236	SLIDING SUPPORT	159
LDF WD001	237	SLIDING SUPPORT	159
LDF WD001	238	SLIDING SUPPORT	377
LDF WD001	239	SLIDING SUPPORT	159
LDF WD001	240	SLIDING SUPPORT	377
LDF WD001	241	SLIDING SUPPORT	159
LDF WD001	242	SLIDING SUPPORT	377
LDF WD001	243	SLIDING SUPPORT	159
LDF WD001	244	SLIDING SUPPORT	377
LDF WD001	245	SLIDING SUPPORT	159
LDF WD001	246	SLIDING SUPPORT	377
LDF WD001	247	SLIDING SUPPORT	377
LDF WD001	248	SLIDING SUPPORT	377
LDF WD001	249	SLIDING SUPPORT	377
LDF WD001	250	SLIDING SUPPORT	377
LDF WD001	251	SLIDING SUPPORT	377
LDF WD001	252	SLIDING SUPPORT	159
LDP WD001	1	SLIDING SUPPORT	219
LDP WD001	2	SLIDING SUPPORT	219
LDP WD001	3	SLIDING SUPPORT	108
LDP WD001	4	GUIDE SLIDING SUPPORT	159
LDP WD001	5	SLIDING SUPPORT	108
LDP WD001	6	GUIDE SLIDING SUPPORT	108
LDP WD001	7	IMMOVABLE SUPPORT	108
LDP WD001	8	IMMOVABLE SUPPORT	108
LDP WD001	9	GUIDE SLIDING SUPPORT	108
LDP WD001	10	GUIDE SLIDING SUPPORT	108
LDP WD001	11	SLIDING SUPPORT	108
LDP WD001	12	GUIDE SLIDING SUPPORT	108
LDP WD001	13	IMMOVABLE SUPPORT	159
LDP WD001	14	SLIDING SUPPORT	108
LDP WD001	15	GUIDE SLIDING SUPPORT	108
LDP WD001	16	SLIDING SUPPORT	159
LDP WD001	17	IMMOVABLE SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDP WD001	18	GUIDE SLIDING SUPPORT	159
LDP WD001	19	GUIDE SLIDING SUPPORT	159
LDP WD001	20	SLIDING SUPPORT	108
LDP WD001	21	SLIDING SUPPORT	108
LDP WD001	22	SLIDING SUPPORT	108
LDP WD001	23	SLIDING SUPPORT	108
LDP WD001	24	SLIDING SUPPORT	159
LDP WD001	25	SLIDING SUPPORT	159
LDP WD001	26	SLIDING SUPPORT	159
LDP WD001	27	SLIDING SUPPORT	159
LDP WD001	28	SLIDING SUPPORT	159
LDP WD001	29	SLIDING SUPPORT	159
LDP WD001	30	SLIDING SUPPORT	159
LDP WD001	31	SIMPLE SUPPORT	159
LDP WD001	32	SLIDING SUPPORT	159
LDP WD001	33	SLIDING SUPPORT	108
LDP WD001	34	SLIDING SUPPORT	159
LDP WD001	35	SLIDING SUPPORT	108
LDP WD001	36	SLIDING SUPPORT	108
LDP WD001	37	SLIDING SUPPORT	159
LDP WD001	38	SLIDING SUPPORT	108
LDP WD001	39	SLIDING SUPPORT	159
LDP WD001	40	SLIDING SUPPORT	159
LDP WD001	41	SLIDING SUPPORT	159
LDP WD001	42	SLIDING SUPPORT	159
LDP WD001	43	SLIDING SUPPORT	108
LDP WD001	44	SLIDING SUPPORT	108
LDP WD001	45	SLIDING SUPPORT	108
LDP WD001	46	SLIDING SUPPORT	108
LDP WD001	47	IMMOVABLE SUPPORT	108
LDP WD001	48	SLIDING SUPPORT	108
LDP WD001	49	SLIDING SUPPORT	108
LDP WD001	50	SLIDING SUPPORT	108
LDP WD001	51	IMMOVABLE SUPPORT	108
LDP WD001	52	IMMOVABLE SUPPORT	108
LDP WD001	53	GUIDE SLIDING SUPPORT	108
LDP WD001	54	GUIDE SLIDING SUPPORT	108
LDP WD001	55	SLIDING SUPPORT	108
LDP WD001	56	SLIDING SUPPORT	108
LDP WD001	57	SLIDING SUPPORT	108
LDP WD001	58	SLIDING SUPPORT	108
LDP WD001	59	GUIDE SLIDING SUPPORT	108
LDP WD001	60	IMMOVABLE SUPPORT	108
LDP WD001	61	GUIDE SLIDING SUPPORT	108
LDP WD001	62	SLIDING SUPPORT	108
LDP WD001	63	SLIDING SUPPORT	108
LDP WD001	64	SLIDING SUPPORT	108
LDP WD001	65	SLIDING SUPPORT	108
LDP WD001	66	SLIDING SUPPORT	108
LDP WD001	67	SLIDING SUPPORT	108
LDP WD001	68	IMMOVABLE SUPPORT	108

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDP WD001	69	GUIDE SLIDING SUPPORT	108
LDP WD001	70	GUIDE SLIDING SUPPORT	108
LDP WD001	71	SLIDING SUPPORT	108
LDP WD001	72	SLIDING SUPPORT	159
LDP WD001	73	SLIDING SUPPORT	159
LDP WD001	74	IMMOVABLE SUPPORT	159
LDP WD001	75	GUIDE SLIDING SUPPORT	159
LDP WD001	76	GUIDE SLIDING SUPPORT	159
LDP WD001	77	GUIDE SLIDING SUPPORT	159
LDP WD001	78	GUIDE SLIDING SUPPORT	108
LDP WD001	79	GUIDE SLIDING SUPPORT	108
LDP WD001	80	GUIDE SLIDING SUPPORT	108
LDP WD001	81	IMMOVABLE SUPPORT	108
LDP WD002	1	IMMOVABLE SUPPORT	89
LDP WD002	2	SLIDING SUPPORT	89
LDP WD002	3	GUIDE SLIDING SUPPORT	89
LDP WD002	4	IMMOVABLE SUPPORT	89
LDP WD002	5	GUIDE SLIDING SUPPORT	89
LDP WD002	6	SLIDING SUPPORT	89
LDP WD002	7	SLIDING SUPPORT	89
LDP WD002	8	GUIDE SLIDING SUPPORT	89
LDP WD002	9	IMMOVABLE SUPPORT	89
LDP WD002	10	SLIDING SUPPORT	89
LDP WD002	11	SLIDING SUPPORT	89
LDP WD002	12	SLIDING SUPPORT	89
LDP WD002	13	IMMOVABLE SUPPORT	89
LDP WD002	14	SLIDING SUPPORT	89
LDP WD002	15	GUIDE SLIDING SUPPORT	89
LDP WD002	16	SLIDING SUPPORT	89
LDP WD002	17	SLIDING SUPPORT	89
LDP WD002	18	SLIDING SUPPORT	89
LDP WD002	19	SLIDING SUPPORT	89
LDP WD002	20	SLIDING SUPPORT	89
LDRWD001	1	SLIDING SUPPORT	159
LDRWD001	2	SLIDING SUPPORT	159
LDRWD001	3	SLIDING SUPPORT	159
LDRWD001	4	GUIDE SLIDING SUPPORT	159
LDRWD001	5	SLIDING SUPPORT	159
LDRWD001	6	SLIDING SUPPORT	159
LDRWD001	7	SLIDING SUPPORT	159
LDRWD001	8	FIXED SUPPORT	159
LDRWD001	9	BLOCK HANGER	159
LDRWD001	10	SLIDING SUPPORT	159
LDRWD001	11	SLIDING SUPPORT	159
LDRWD001	12	GUIDE SLIDING SUPPORT	159
LDRWD001	13	SLIDING SUPPORT	159
LDRWD001	14	SLIDING SUPPORT	159
LDRWD001	15	SLIDING SUPPORT	108
LDRWD001	16	SLIDING SUPPORT	159
LDRWD001	17	SLIDING SUPPORT	159
LDRWD001	18	GUIDE SLIDING SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDRWD001	19	SLIDING SUPPORT	159
LDRWD001	20	SLIDING SUPPORT	159
LDRWD001	21	SLIDING SUPPORT	159
LDRWD001	22	GUIDE SLIDING SUPPORT	159
LDRWD001	23	FIXED SUPPORT	159
LDRWD001	24	SLIDING SUPPORT	159
LDRWD001	25	SLIDING SUPPORT	159
LDRWD001	26	GUIDE SLIDING SUPPORT	159
LDRWD001	27	SLIDING SUPPORT	159
LDRWD001	28	SLIDING SUPPORT	159
LDRWD001	29	SLIDING SUPPORT	159
LDRWD001	30	GUIDE SLIDING SUPPORT	159
LDRWD001	31	FIXED SUPPORT	159
LDRWD001	32	SLIDING SUPPORT	159
LDRWD001	33	SLIDING SUPPORT	159
LDRWD001	34	SLIDING SUPPORT	159
LDRWD001	35	GUIDE SLIDING SUPPORT	159
LDRWD001	36	SLIDING SUPPORT	159
LDRWD001	37	BLOCK HANGER	159
LDRWD001	38	SLIDING SUPPORT	159
LDRWD001	39	SLIDING SUPPORT	159
LDRWD001	40	SLIDING SUPPORT	159
LDRWD001	41	SLIDING SUPPORT	159
LDRWD001	42	SLIDING SUPPORT	159
LDRWD001	43	SLIDING SUPPORT	159
LDRWD001	44	SLIDING SUPPORT	220
LDRWD001	45	SLIDING SUPPORT	273
LDRWD001	46	BLOCK HANGER	273
LDRWD001	47	SLIDING SUPPORT	159
LDRWD001	48	SLIDING SUPPORT	108
LDRWD001	49	SIMPLE HANGER	108
LDRWD001	50	SLIDING SUPPORT	108
LDRWD001	51	GUIDE SLIDING SUPPORT	108
LDRWD001	52	SLIDING SUPPORT	108
LDRWD001	53	SLIDING SUPPORT	108
LDRWD001	54	SLIDING SUPPORT	108
LDRWD001	55	SLIDING SUPPORT	108
LDRWD001	56	SLIDING SUPPORT	108
LDRWD001	57	SLIDING SUPPORT	108
LDRWD001	58	SLIDING SUPPORT	108
LDRWD001	59	GUIDE SLIDING SUPPORT	108
LDRWD001	60	SLIDING SUPPORT	108
LDRWD001	61	SLIDING SUPPORT	108
LDRWD001	62	SLIDING SUPPORT	108
LDRWD001	63	FIXED SUPPORT	108
LDRWD001	64	SLIDING SUPPORT	108
LDRWD001	65	FIXED SUPPORT	108
LDRWD001	66	FIXED SUPPORT	108
LDRWD001	67	GUIDE SLIDING SUPPORT	108
LDRWD001	68	SLIDING SUPPORT	108
LDRWD001	69	SLIDING SUPPORT	108

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LDRWD001	70	SLIDING SUPPORT	108
LDRWD001	71	SIMPLE HANGER	108
LDRWD001	72	SLIDING SUPPORT	108
LDRWD001	73	GUIDE SLIDING SUPPORT	108
LDRWD001	74	SLIDING SUPPORT	108
LDRWD001	75	GUIDE SLIDING SUPPORT	108
LDRWD001	76	SLIDING SUPPORT	108
LDRWD001	77	SLIDING SUPPORT	108
LDRWD001	78	SLIDING SUPPORT	108
LDRWD001	79	FIXED SUPPORT	108
LDRWD001	80	SLIDING SUPPORT	108
LDRWD001	81	GUIDE SLIDING SUPPORT	108
LDRWD001	82	SLIDING SUPPORT	108
LDRWD001	83	CLIP BLOCK	108
LDRWD001	84	CLIP BLOCK	108
LDRWD001	85	FIXED SUPPORT	108
LDRWD001	86	GUIDE SLIDING SUPPORT	108
LDRWD001	87	SLIDING SUPPORT	108
LDRWD001	88	SLIDING SUPPORT	108
LDRWD001	89	GUIDE SLIDING SUPPORT	108
LDRWD001	90	FIXED SUPPORT	108
LDRWD001	91	FIXED SUPPORT	108
LDRWD001	92	FIXED SUPPORT	108
LDRWD001	93	SLIDING SUPPORT	159
LDRWD001	94	SLIDING SUPPORT	159
LDRWD001	95	SLIDING SUPPORT	159
LDRWD001	96	SLIDING SUPPORT	159
LDRWD001	97	FIXED SUPPORT	159
LDRWD001	98	FIXED SUPPORT	159
LDRWD001	99	GUIDE SLIDING SUPPORT	159
LDRWD001	100	SIMPLE HANGER	159
LDRWD001	101	GUIDE SLIDING SUPPORT	159
LDRWD001	102	SIMPLE HANGER	159
LDRWD001	103	SLIDING SUPPORT	159
LDRWD001	104	FIXED SUPPORT	159
LDRWD001	105	BLOCK HANGER	159
LDRWD001	106	SLIDING SUPPORT	108
LDRWD001	107	SLIDING SUPPORT	159
LDRWD001	108	SLIDING SUPPORT	159
LDRWD001	109	GUIDE SLIDING SUPPORT	159
LDRWD001	110	SLIDING SUPPORT	159
LDRWD001	111	SLIDING SUPPORT	159
LDRWD001	112	SLIDING SUPPORT	159
LDRWD001	113	GUIDE SLIDING SUPPORT	159
LAA WD001	1	SPRING HANGER	159
LAA WD001	2	GUIDE SLIDING SUPPORT	159
LAA WD001	3	SPRING HANGER	159
LAA WD001	4	GUIDE SLIDING SUPPORT	159
LAA WD001	5	SPRING HANGER	159
LAA WD001	6	SPRING HANGER	159
LAA WD001	7	GUIDE SLIDING SUPPORT	159

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAA WD001	8	SPRING HANGER	159
LAA WD001	9	RIGID HANGER	159
LAA WD001	10	GUIDE SLIDING SUPPORT	159
LAA WD001	11	SPRING HANGER	159
LAA WD001	12	GUIDE SLIDING SUPPORT	159
LAA WD001	13	SPRING HANGER	159
LAA WD001	14	SPRING HANGER	159
LAA WD001	15	IMMOVABLE SUPPORT	159
LAA WD001	16	SPRING HANGER	159
LAA WD001	17	GUIDE SUPPORT	159
LAA WD001	18	SPRING HANGER	159
LAA WD001	19	SPRING HANGER	159
LAA WD001	20	SLIDING SUPPORT	159
LAA WD001	21	GUIDE SLIDING SUPPORT	159
LAA WD001	22	SLIDING SUPPORT	14
LAA WD001	23	GUIDE SLIDING SUPPORT	14
LAA WD001	24	GUIDE SLIDING SUPPORT	14
LAA WD001	25	GUIDE SUPPORT	14
LAA WD001	26	GUIDE SLIDING SUPPORT	14
LAA WD001	27	GUIDE SLIDING SUPPORT	14
LAA WD001	28	GUIDE SLIDING SUPPORT	14
LAA WD001	29	GUIDE SUPPORT	14
LAA WD001	30	GUIDE SUPPORT	14
LAA WD001	31	GUIDE SUPPORT	14
LAA WD001	32	GUIDE SUPPORT	14
LAA WD001	33	GUIDE SUPPORT	14
LAA WD001	34	SLIDING SUPPORT	14
LAA WD001	35	GUIDE SLIDING SUPPORT	14
LAA WD001	36	GUIDE SLIDING SUPPORT	14
LAA WD001	37	GUIDE SLIDING SUPPORT	14
LAA WD001	38	GUIDE SLIDING SUPPORT	14
LAA WD001	39	GUIDE SLIDING SUPPORT	14
LAA WD001	40	GUIDE SLIDING SUPPORT	14
LAA WD001	41	GUIDE SLIDING SUPPORT	14
LAA WD001	42	GUIDE SLIDING SUPPORT	14
LAA WD001	43	GUIDE SLIDING SUPPORT	14
LAA WD001	44	GUIDE SUPPORT	14
LAA WD001	45	GUIDE SUPPORT	14
LAA WD001	46	GUIDE SUPPORT	14
LAA WD001	47	GUIDE SUPPORT	14
LAA WD001	48	GUIDE SUPPORT	14
LAA WD001	49	GUIDE SLIDING SUPPORT	14
LAA WD001	50	GUIDE SLIDING SUPPORT	14
LAA WD001	51	GUIDE SLIDING SUPPORT	14
LAA WD001	52	GUIDE SLIDING SUPPORT	14
LAA WD001	53	GUIDE SLIDING SUPPORT	14
LAA WD001	54	GUIDE SLIDING SUPPORT	14
LAA WD001	55	GUIDE SLIDING SUPPORT	14
LAA WD001	56	GUIDE SLIDING SUPPORT	14
LAA WD001	57	GUIDE SLIDING SUPPORT	14
LAA WD001	58	GUIDE SUPPORT	14

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAA WD001	59	GUIDE SUPPORT	14
LAA WD001	60	GUIDE SUPPORT	14
LAA WD001	61	GUIDE SUPPORT	14
LAA WD001	62	SLIDING SUPPORT	108
LAA WD001	63	SLIDING SUPPORT	108
LAA WD001	64	SLIDING SUPPORT	108
LAA WD001	65	SLIDING SUPPORT	108
LAA WD001	66	GUIDE SLIDING SUPPORT	325
LAA WD001	67	SLIDING SUPPORT	325
LAA WD001	68	IMMOVABLE SUPPORT	325
LAA WD001	69	SPRING HANGER	325
LAA WD001	70	IMMOVABLE SUPPORT	219
LAA WD001	71	SPRING HANGER	219
LAA WD001	72	GUIDE SUPPORT	219
LAA WD001	73	SLIDING SUPPORT	219
LAA WD001	74	SLIDING SUPPORT	219
LAA WD001	75	SLIDING SUPPORT	219
LAA WD001	76	GUIDE SUPPORT	219
LAA WD001	77	GUIDE SUPPORT	219
LAA WD001	78	IMMOVABLE SUPPORT	219
LAA WD001	79	IMMOVABLE SUPPORT	89
LAA WD001	80	SPRING HANGER	89
LAA WD001	81	GUIDE SLIDING SUPPORT	89
LAA WD001	82	IMMOVABLE SUPPORT	108
LAA WD001	83	SPRING HANGER	159
LAA WD001	84	SLIDING SUPPORT	630
LAA WD001	85	SLIDING SUPPORT	630
LAA WD001	86	IMMOVABLE SUPPORT	14
LAA WD001	87	IMMOVABLE SUPPORT	14
LAA WD001	88	IMMOVABLE SUPPORT	14
LAB WD001	1	GUIDE SILDING SUPPORT	720X9
LAB WD001	2	SPRING SUPPORT	720X9
LAB WD001	3	GUIDE SUPPORT	720X9
LAB WD001	4	SPRING HANGERS	720X9
LAB WD001	5	GUIDE SUPPORT	720X9
LAB WD001	6	FIXED SUPPORT	820X9
LAB WD001	7	SPRING HANGERS	820X9
LAB WD001	8	SPRING HANGERS	720X9
LAB WD001	9	GUIDE SUPPORT	720X9
LAB WD001	10	SPRING HANGERS	630X12
LAB WD001	11	GUIDE SILDING SUPPORT	57X3
LAB WD001	12	FIXED SUPPORT	57X3
LAB WD001	13	GUIDE SILDING SUPPORT	57X3
LAB WD001	14	SLIDING SUPPORT	57X3
LAB WD001	15	GUIDE SILDING SUPPORT	57X3
LAB WD001	16	SLIDING SUPPORT	57X3
LAB WD001	17	GUIDE SILDING SUPPORT	57X3
LAB WD001	18	SIMPLE HANGER	133
LAB WD001	19	FIXED SUPPORT	57X3
LAB WD001	20	FIXED SUPPORT	57X3
LAB WD001	21	GUIDE SILDING SUPPORT	720X9

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB WD001	22	SPRING HANGERS	720X9
LAB WD001	23	GUIDE SUPPORT	720X9
LAB WD001	24	SPRING HANGERS	720X9
LAB WD001	25	GUIDE SUPPORT	720X9
LAB WD001	26	FIXED SUPPORT	820X9
LAB WD001	27	SPRING HANGERS	820X9
LAB WD001	28	SPRING HANGERS	720X9
LAB WD001	29	GUIDE SUPPORT	720X9
LAB WD001	30	SPRING HANGERS	630X12
LAB WD001	31	SLIDING SUPPORT	57X3
LAB WD001	32	FIXED SUPPORT	57X3
LAB WD001	33	GUIDE SLIDING SUPPORT	57X3
LAB WD001	34	GUIDE SLIDING SUPPORT	57X3
LAB WD001	35	GUIDE SLIDING SUPPORT	57X3
LAB WD001	36	SLIDING SUPPORT	57X3
LAB WD001	37	GUIDE SLIDING SUPPORT	57X3
LAB WD001	38	GUIDE SLIDING SUPPORT	57X3
LAB WD001	39	GUIDE SLIDING SUPPORT	57X3
LAB WD001	40	FIXED SUPPORT	57X3
LAB WD001	41	GUIDE SLIDING SUPPORT	57X3
LAB WD001	42	GUIDE SLIDING SUPPORT	57X3
LAB WD001	43	GUIDE SLIDING SUPPORT	57X3
LAB WD001	44	GUIDE SLIDING SUPPORT	57X3
LAB WD001	45	GUIDE SLIDING SUPPORT	57X3
LAB WD001	46	GUIDE SLIDING SUPPORT	57X3
LAB WD001	47	FIXED SUPPORT	57X3
LAB WD001	48	GUIDE SLIDING SUPPORT	57X3
LAB WD001	49	FIXED SUPPORT	57X3
LAB WD001	50	GUIDE SLIDING SUPPORT	57X3
LAB WD001	51	SLIDING SUPPORT	57X3
LAB WD001	52	GUIDE SLIDING SUPPORT	57X3
LAB WD001	53	SIMPLE HANGER	133
LAB WD001	54	FIXED SUPPORT	57X3
LAB WD001	55	FIXED SUPPORT	57X3
LAB WD001	56	SPRING HANGERS	530X8
LAB WD001	57	SPRING HANGERS	530X8
LAB WD001	58	SPRING HANGERS	530X8
LAB WD001	59	FIXED SUPPORT	530X8
LAB WD001	60	GUIDE SUPPORT	426X9
LAB WD001	61	SPRING HANGERS	426X9
LAB WD001	62	SPRING HANGERS	426X9
LAB WD001	63	GUIDE SLIDING SUPPORT	57X3
LAB WD001	64	SPRING HANGERS	57X3
LAB WD001	65	FIXED SUPPORT	57X3
LAB WD001	66	GUIDE SLIDING SUPPORT	57X3
LAB WD001	67	SLIDING SUPPORT	57X3
LAB WD001	68	GUIDE SLIDING SUPPORT	57X3
LAB WD001	69	SLIDING SUPPORT	57X3
LAB WD001	70	SLIDING SUPPORT	57X3
LAB WD001	71	SLIDING SUPPORT	57X3
LAB WD001	72	SPRING HANGERS	530X8

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB WD001	73	SPRING HANGERS	530X8
LAB WD001	74	FIXED SUPPORT	530X8
LAB WD001	75	GUIDE SUPPORT	426X9
LAB WD001	76	SPRING HANGERS	426X9
LAB WD001	77	SPRING HANGERS	426X9
LAB WD001	78	GUIDE SLIDING SUPPORT	57X3
LAB WD001	79	FIXED SUPPORT	57X3
LAB WD001	80	GUIDE SLIDING SUPPORT	57X3
LAB WD001	81	SLIDING SUPPORT	57X3
LAB WD001	82	FIXED SUPPORT	57X3
LAB WD001	83	GUIDE SLIDING SUPPORT	57X3
LAB WD001	84	SLIDING SUPPORT	57X3
LAB WD001	85	GUIDE SLIDING SUPPORT	57X3
LAB WD001	86	SLIDING SUPPORT	57X3
LAB WD001	87	GUIDE SUPPORT	325X8
LAB WD001	88	SPRING HANGERS	325X8
LAB WD001	89	SPRING HANGERS	325X8
LAB WD001	90	GUIDE SUPPORT	325X8
LAB WD001	91	SPRING HANGERS	325X8
LAB WD001	92	SPRING HANGERS	325X8
LAB WD001	93	GUIDE SUPPORT	219X7
LAB WD001	94	SPRING HANGERS	219X7
LAB WD001	95	FIXED SUPPORT	219X7
LAB WD001	96	SPRING HANGERS	219X7
LAB WD001	97	SPRING HANGERS	219X7
LAB WD001	98	SPRING HANGERS	219X7
LAB WD001	99	SPRING HANGERS	219X7
LAB WD001	100	FIXED SUPPORT	219X7
LAB WD001	101	SPRING HANGERS	219X7
LAB WD001	102	SPRING HANGERS	219X7
LAB WD001	103	SPRING HANGERS	219X7
LAB WD001	104	FIXED SUPPORT	32X2.5
LAB WD001	105	SPRING HANGERS	32X2.5
LAB WD001	106	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	107	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	108	SLIDING SUPPORT	32X2.5
LAB WD001	109	SLIDING SUPPORT	32X2.5
LAB WD001	110	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	111	SLIDING SUPPORT	32X2.5
LAB WD001	112	SLIDING SUPPORT	32X2.5
LAB WD001	113	SLIDING SUPPORT	32X2.5
LAB WD001	114	SPRING HANGERS	32X2.5
LAB WD001	115	FIXED SUPPORT	32X2.5
LAB WD001	116	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	117	SPRING HANGERS	32X2.5
LAB WD001	118	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	119	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	120	SLIDING SUPPORT	32X2.5
LAB WD001	121	SLIDING SUPPORT	32X2.5
LAB WD001	122	SLIDING SUPPORT	32X2.5
LAB WD001	123	SLIDING SUPPORT	32X2.5

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LAB WD001	124	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	125	SLIDING SUPPORT	32X2.5
LAB WD001	126	SLIDING SUPPORT	32X2.5
LAB WD001	127	SLIDING SUPPORT	32X2.5
LAB WD001	128	SPRING HANGERS	57X3
LAB WD001	129	SLIDING SUPPORT	57X3
LAB WD001	130	SPRING HANGERS	57X3
LAB WD001	131	SLIDING SUPPORT	57X3
LAB WD001	132	SPRING HANGERS	57X3
LAB WD001	133	SPRING HANGERS	57X3
LAB WD001	134	GUIDE SLIDING SUPPORT	57X3
LAB WD001	135	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	136	SPRING HANGERS	32X2.5
LAB WD001	137	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	138	GUIDE SLIDING SUPPORT	32X2.5
LAB WD001	139	SPRING HANGERS	32X2.5
LAB WD001	140	SLIDING SUPPORT	32X2.5
LAB WD001	141	SLIDING SUPPORT	32X2.5
LAB WD001	142	SPRING HANGERS	57X3
LAB WD001	143	SLIDING SUPPORT	57X3
LAB WD001	144	GUIDE SLIDING SUPPORT	57X3
LAB WD001	145	GUIDE SLIDING SUPPORT	57X3
LAB WD001	146	SPRING HANGERS	57X3
LAB WD001	147	SPRING HANGERS	57X3
LAB WD001	148	SPRING HANGERS	57X3
LAB WD001	149	SLIDING SUPPORT	57X3
LAB WD001	150	GUIDE SLIDING SUPPORT	57X3
LAB WD001	151	SLIDING SUPPORT	57X3
LAB WD001	152	SLIDING SUPPORT	57X3
LAB WD001	153	FIXED SUPPORT	57X3
LAB WD001	154	SPRING HANGERS	273x8
LAB WD001	155	FIXED SUPPORT	273x8
LAB WD001	156	SPRING HANGERS	273x8
LAB WD001	157	GUIDE SUPPORT	273x8
LAB WD001	158	SPRING HANGERS	273x8
LAB WD001	159	SLDING GUIDE SUPPORT	273x8
LAB WD001	160	SPRING HANGERS	273x8
LAB WD001	161	SPRING HANGERS	273x8
LAB WD001	162	GUIDE SUPPORT	273x8
LAB WD001	163	FIXED SUPPORT	273x8
LAB WD001	164	SPRING HANGERS	273x8
LAB WD001	165	SPRING HANGERS	273x8
LAB WD001	166	SPRING HANGERS	273x8
LAB WD001	167	SLDING GUIDE SUPPORT	273x8
LAB WD001	168	SLDING GUIDE SUPPORT	273x8
LAB WD001	169	SLDING GUIDE SUPPORT	273x8
LAB WD001	170	SLDING SUPPORT	273x8
LABWD003	1	SPRING HANGER	530
LABWD003	2	GUIDE SUPPORT	530
LABWD003	3	SPRING HANGER	530
LABWD003	4	SPRING HANGER	530

ANNEXURE V

List of Supports

KKS	*Support No.*	*Type*	*Dia*
LABWD003	*5*	*GUIDE SUPPORT*	*530*
LABWD003	*6*	*SPRING HANGER*	*530*
LABWD003	*7*	*SPRING HANGER*	*530*
LABWD003	*8*	*GUIDE SUPPORT*	*530*
LABWD003	*9*	*SPRING HANGER*	*530*
LABWD003	*10*	*SPRING HANGER*	*530*
LABWD003	*11*	*GUIDE SUPPORT*	*530*
LABWD003	*12*	*SPRING HANGER*	*530*
LABWD003	*13*	*SLIDING SUPPORT*	*32*
LABWD003	*14*	*IMMOVABLE SUPPORT*	*32*
LABWD003	*15*	*SLIDING SUPPORT*	*32*
LABWD003	*16*	*IMMOVABLE SUPPORT*	*32*
LACWD001	*1*	*SLIDING SUPPORT*	*57*
LACWD001	*2*	*SLIDING SUPPORT*	*57*
LACWD001	*3*	*SLIDING SUPPORT*	*57*
LACWD001	*4*	*SLIDING SUPPORT*	*57*
LACWD001	*5*	*IMMOVABLE SUPPORT*	*32*
LACWD001	*6*	*GUIDE SLIDING SUPPORT*	*32*
LACWD001	*7*	*GUIDE SLIDING SUPPORT*	*32*
LACWD001	*8*	*GUIDE SLIDING SUPPORT*	*32*
LACWD001	*9*	*SLIDING SUPPORT*	*89*
LACWD001	*10*	*GUIDE SLIDING SUPPORT*	*32*
LACWD001	*11*	*IMMOVABLE SUPPORT*	*38*
LACWD001	*12*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*13*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*14*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*15*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*16*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*17*	*IMMOVABLE SUPPORT*	*38*
LACWD001	*18*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*19*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*20*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*21*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*22*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*23*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*24*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*25*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*26*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*27*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*28*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*29*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*30*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*31*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*32*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*33*	*IMMOVABLE SUPPORT*	*38*
LACWD001	*34*	*GUIDE SLIDING SUPPORT*	*38*
LACWD001	*35*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*36*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*37*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*38*	*GUIDE SLIDING SUPPORT*	*25*
LACWD001	*39*	*GUIDE SLIDING SUPPORT*	*25*

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LACWD001	40	GUIDE SLIDING SUPPORT	25
LACWD001	41	IMMOVABLE SUPPORT	32
LACWD001	42	GUIDE SLIDING SUPPORT	32
LACWD001	43	GUIDE SLIDING SUPPORT	32
LACWD001	44	GUIDE SLIDING SUPPORT	32
LACWD001	45	GUIDE SLIDING SUPPORT	32
LACWD001	46	GUIDE SLIDING SUPPORT	32
LACWD001	47	GUIDE SLIDING SUPPORT	32
LACWD001	48	GUIDE SLIDING SUPPORT	32
LACWD001	49	GUIDE SLIDING SUPPORT	32
LACWD001	50	GUIDE SLIDING SUPPORT	32
LACWD001	51	GUIDE SLIDING SUPPORT	32
LACWD001	52	GUIDE SLIDING SUPPORT	32
LACWD001	53	GUIDE SLIDING SUPPORT	32
LACWD001	54	GUIDE SLIDING SUPPORT	76
LACWD001	55	IMMOVABLE SUPPORT	32
LACWD001	56	GUIDE SLIDING SUPPORT	32
LACWD001	57	GUIDE SLIDING SUPPORT	32
LACWD001	58	GUIDE SLIDING SUPPORT	32
LACWD001	59	GUIDE SLIDING SUPPORT	32
LACWD001	60	GUIDE SLIDING SUPPORT	32
LACWD001	61	GUIDE SLIDING SUPPORT	32
LACWD001	62	GUIDE SLIDING SUPPORT	32
LACWD001	63	GUIDE SLIDING SUPPORT	32
LACWD001	64	GUIDE SLIDING SUPPORT	32
LACWD001	65	GUIDE SLIDING SUPPORT	32
LACWD001	66	GUIDE SLIDING SUPPORT	32
LACWD001	67	GUIDE SLIDING SUPPORT	32
LACWD001	68	GUIDE SLIDING SUPPORT	32
LACWD001	69	GUIDE SLIDING SUPPORT	25
LACWD001	70	GUIDE SLIDING SUPPORT	25
LACWD001	71	GUIDE SLIDING SUPPORT	25
LACWD001	72	GUIDE SLIDING SUPPORT	25
LACWD001	73	GUIDE SLIDING SUPPORT	25
LACWD001	74	GUIDE SLIDING SUPPORT	25
LACWD001	75	GUIDE SLIDING SUPPORT	25
LACWD001	76	GUIDE SLIDING SUPPORT	32
LACWD001	77	GUIDE SLIDING SUPPORT	32
LACWD001	78	GUIDE SLIDING SUPPORT	32
LACWD001	79	GUIDE SLIDING SUPPORT	32
LACWD001	80	GUIDE SLIDING SUPPORT	32
LACWD001	81	GUIDE SLIDING SUPPORT	32
LACWD001	82	SLIDING SUPPORT	57
LACWD001	83	GUIDE SLIDING SUPPORT	57
LACWD001	84	SLIDING SUPPORT	57
LACWD001	85	GUIDE SLIDING SUPPORT	57
LACWD001	86	IMMOVABLE SUPPORT	57
LACWD001	87	GUIDE SLIDING SUPPORT	57
LACWD001	88	SLIDING SUPPORT	57
LACWD001	89	SLIDING SUPPORT	57
LACWD001	90	SLIDING SUPPORT	57

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LACWD001	91	SLIDING SUPPORT	57
LACWD001	92	SLIDING SUPPORT	57
LACWD001	93	SLIDING SUPPORT	57
LACWD001	94	GUIDE SLIDING SUPPORT	57
LACWD001	95	GUIDE SLIDING SUPPORT	57
LACWD001	96	SLIDING SUPPORT	57
LACWD001	97	GUIDE SLIDING SUPPORT	57
LACWD001	98	GUIDE SLIDING SUPPORT	25
LACWD001	99	IMMOVABLE SUPPORT	32
LACWD001	100	SLIDING SUPPORT	32
LACWD001	101	GUIDE SLIDING SUPPORT	32
LACWD001	102	IMMOVABLE SUPPORT	32
LACWD001	103	GUIDE SLIDING SUPPORT	76
LACWD001	104	GUIDE SLIDING SUPPORT	76
LACWD001	105	GUIDE SLIDING SUPPORT	76
LACWD001	106	GUIDE SLIDING SUPPORT	76
LACWD001	107	IMMOVABLE SUPPORT	76
LACWD001	108	GUIDE SLIDING SUPPORT	76
LACWD001	109	GUIDE SLIDING SUPPORT	76
LACWD001	110	GUIDE SLIDING SUPPORT	76
LACWD001	111	GUIDE SLIDING SUPPORT	76
LACWD001	112	GUIDE SLIDING SUPPORT	76
LACWD001	113	SLIDING SUPPORT	76
LACWD001	114	GUIDE SLIDING SUPPORT	32
LACWD001	115	GUIDE SLIDING SUPPORT	76
LACWD001	116	GUIDE SLIDING SUPPORT	89
LACWD001	117	GUIDE SLIDING SUPPORT	89
LACWD001	118	IMMOVABLE SUPPORT	89
LACWD001	119	GUIDE SLIDING SUPPORT	89
LACWD001	120	GUIDE SLIDING SUPPORT	89
LACWD001	121	GUIDE SLIDING SUPPORT	89
LACWD001	122	GUIDE SLIDING SUPPORT	89
LACWD001	123	SLIDING SUPPORT	89
LACWD001	124	SLIDING SUPPORT	32
LACWD001	125	SLIDING SUPPORT	32
LACWD001	126	SLIDING SUPPORT	32
LACWD001	127	SLIDING SUPPORT	32
LACWD001	128	SLIDING SUPPORT	32
LACWD001	129	GUIDE SLIDING SUPPORT	32
LCS50	1	SPRING SUPPORT	325
LCS50	2	SLIDING SUPPORT	325
LCS50	3	IMMOVABLE SUPPORT	325
LCS50	4	RIGID HANGER	325
LCS50	5	SPRING SUPPORT	325
LCS50	6	RIGID HANGER	325
LCS50	7	SPRING SUPPORT	325
LCS50	8	GUIDE SUPPORT	325
LCS50	9	SPRING SUPPORT	325
LCS50	10	GUIDE SUPPORT	325
LCS50	11	SPRING SUPPORT	325
LCS50	12	SPRING SUPPORT	325

ANNEXURE V

List of Supports

KKS	Support No.	Type	Dia
LCS50	13	IMMOVABLE SUPPORT	325
LCS50	14	GUIDE SUPPORT	325
LCS50	15	SPRING SUPPORT	325
LCS50	16	GUIDE SLIDING SUPPORT	108
LCS50	17	SLIDING SUPPORT	108
LCS50	18	GUIDE SLIDING SUPPORT	38
LCS50	19	SPRING SUPPORT	57
LCS50	20	GUIDE SLIDING SUPPORT	57
LCS50	21	IMMOVABLE SUPPORT	57
LCS50	22	SLIDING SUPPORT	57
LCS50	23	SLIDING SUPPORT	57
LCS50	24	SLIDING SUPPORT	57
LCS50	25	IMMOVABLE SUPPORT	57
LCS50	26	GUIDE SUPPORT	57
LCS50	27	SPRING SUPPORT	57
LCS50	28	GUIDE SLIDING SUPPORT	57
LCS50	29	GUIDE SLIDING SUPPORT	57
LCS50	30	GUIDE SLIDING SUPPORT	57
LCS50	31	SLIDING SUPPORT	57
LCS50	32	GUIDE SLIDING SUPPORT	57
LCS50	33	SPRING SUPPORT	57
LCS50	34	GUIDE SUPPORT	57
LCS50	35	GUIDE SLIDING SUPPORT	32
LCS50	36	SLIDING SUPPORT	32
LCS50	37	IMMOVABLE SUPPORT	32
LCS50	38	SLIDING SUPPORT	32
LCS50	39	SLIDING SUPPORT	32
LCS50	40	SPRING SUPPORT	57
LCS50	41	RIGID HANGER	57
LCS50	42	SLIDING SUPPORT	57
LCS50	43	IMMOVABLE SUPPORT	57
LCS50	44	SLIDING SUPPORT	57
LCS50	45	SLIDING SUPPORT	57
LCS50	46	GUIDE SLIDING SUPPORT	57
LCS50	47	SLIDING SUPPORT	57
LCS50	48	SPRING SUPPORT	57
LCS50	49	GUIDE SLIDING SUPPORT	57
LCS50	50	SPRING SUPPORT	57
LCS50	51	SPRING SUPPORT	57
LCS50	52	SPRING SUPPORT	57
LCS50	53	RIGID HANGER	57
LCS50	54	GUIDE SUPPORT	57
LCS50	55	SPRING SUPPORT	57
LCS50	56	SPRING SUPPORT	57
LCS50	57	RIGID HANGER	57
LCS50	58	SPRING SUPPORT	57
LCS50	59	GUIDE SUPPORT	57
LCS50	60	SPRING SUPPORT	57
LCS50	61	IMMOVABLE SUPPORT	57
LCS50	62	GUIDE SUPPORT	57
LCS50	63	SPRING SUPPORT	57

ANNEXURE V

List of Supports

KKS	*Support No.*	*Type*	*Dia*
LCS50	*64*	*GUIDE SLIDING SUPPORT*	*57*
LCS50	*65*	*SLIDING SUPPORT*	*57*
LCS50	*66*	*SLIDING SUPPORT*	*57*
LCS50	*67*	*GUIDE SUPPORT*	*57*
LCS50	*68*	*SLIDING SUPPORT*	*57*
LCS50	*69*	*GUIDE SLIDING SUPPORT*	*57*
LCS50	*70*	*RIGID HANGER*	*57*

ANNEXURE – VI
LIST OF VALVES

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
1	LCP	R01.KK34.30/40UMA.LCP.TM.OK.WD001-rev0	MANNUALLY OPERATED WEDGE GATE VALVE	LCP10AA101 LCP20AA101	NB 200
			BACKWATER GATE	LCP10AA601 LCP20AA601 LCP38AA601	NB 150
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP10AA001 LCP20AA001 LCP38AA001	NB 150
			BACKWATER GATE	LCP33AA601	NB 100
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP39AA001	NB 100
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP35AA002 LCP35AA003 LCP35AA004 LCP35AA005	NB 50
			CHECK VALVE	LCP35AA601	NB 50
			CHECK VALVE	LCP31AA601	NB 50
			MANNUALLY OPERATED STOP VALVE	LCP33AA101 LCP37AA101	NB 32
			MANNUALLY OPERATED STOP VALVE	LCP34AA101 LCP36AA101	NB 25
			REGULATING VALVE WITH REMOTE	LCP38AA201	NB 150
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP39AA002	NB 80
			ELECTRICALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP10AA401 LCP20AA401 LCP10AA402	NB 20
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP35AA401	NB 10
			CHECK GATE	LCP11AA601 LCP21AA601	NB 80
			MOTOR OPERATED BELLOWS STOP VALVE	LCP11AA001 LCP21AA001	NB 80
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP11AA401 LCP11AA402	NB 15
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP40AA001	NB 150
			REGULATING VALVE WITH REMOTE	LCP40AA201	NB 150
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LCP41AA001	NB 100
			REGULATING VALVE WITH REMOTE	LCP41AA201	NB 100
			ELECTRICALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP03AA403	NB 20

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP41AA401	NB 15
			FLANGED RISING STEM WEDGE GATE VALVE	LCP05AA002	NB 250
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP05AA402	NB 20
		R01.KK34.30/40UMA.LCP.TM.OK.WD002-rev0	MANUALLY OPERATED BELLOWS STOP VALVE	LCP03AA101 LCP04AA101	NB 150
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP03AA401 LCP04AA401 LCP03AA404	NB 20
			MANUALLY OPERATED BELLOWS STOP VALVE	LCP60AA101 LCP50AA102 LCP50AA103	NB 50
			MANUALLY OPERATED BELLOWS STOP VALVE	LCP50AA101	NB 80
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP50AA401	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP03AA402 LCP04AA402 LCP05AA401	NB 10
			ELECTRICALLY OPERATED BELLOWS STOP VALVE WITH A LOCK	LCP05AA001	NB 100
2	LDN	R01.KK34.30/40UMA.LDN.TM.OK.WD001-rev0	MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA101	NB 50
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA109	NB 25
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA110	NB 10
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA102	NB 15
				LDN10AA104	
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA106	NB 15
				LDN10AA107	
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA103	NB 15
				LDN10AA105	
			CHECK VALVE	LDN10AA601	NB 15
				LDN10AA602	
			MANUALLY OPEARATED FLANGED BALL COCK	LDN10AA108	NB 25

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			ELECTRICALLY OPERATED BALL VALVE	LFN20AA001	NB 32
				LFN20AA003	
			ELECTRICALLY OPERATED WEDGE RISING STEM FLANGED GATE VALVE	LFN10AA001	NB 50
				LFN10AA003	
			ELECTRICALLY OPERATED WEDGE RISING STEM FLANGED GATE VALVE	LFN20AA002	NB 50
				LFN20AA004	
				LFN10AA002	
				LFN10AA004	
			STOP VALVE	LFN20AA120	NB 15
				LFN20AA121	
				LFN10AA120	
				LFN10AA121	
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN20AA124	NB 10
				LFN20AA125	
				LFN10AA129	
				LFN10AA134	
				LFN10AA135	
			STOP VALVE	LFN20AA111	NB 15
				LFN20AA112	
				LFN10AA127	
				LFN10AA128	
				LFN20AA107	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
3	LFN	R01.KK34.30/40UMA.LFN.TM.OK.WD001-rev0	MANUALLY OPERATED FLANGED STOP VALVE	LFN20AA108	NB 25
				LFN10AA108	
				LFN10AA109	
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN10AA110	NB 10
				LFN10AA111	
			MANUALLY OPERATED FLANGED STOP VALVE	LFN10AA102	NB 25
				LFN10AA103	
				LFN10AA104	
				LFN10AA105	
				LFN10AA122	
			STOP VALVE	LFN10AA106	NB 15
				LFN10AA107	
				LFN10AA114	
				LFN10AA115	
				LFN10AA116	
				LFN10AA117	
				LFN10AA118	
				LFN10AA119	
				LFN10AA125	
				LFN10AA126	
			CHECK VALVE	LFN10AA601	NB 15
				LFN10AA602	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
				LFN10AA603	
			MANUALLY OPERATED STOP VALVE	LFN20AA105	NB 15
				LFN20AA106	
				LFN20AA117	
				LFN20AA118	
				LFN20AA122	
				LFN20AA123	
			STOP VALVE	LFN20AA114	NB 15
			CHECK VALVE	LFN20AA601	NB 15
			BALL COCK	LFN20AA133	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN20AA401	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN10AA124	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN10AA112	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN10AA113	NB 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LFN10AA130	NB 15
				LFN10AA131	
				LFN10AA132	
		R01.KK34.30/40UMA.JEA50.TM.OK.WD001-rev0	MANUALLY OPERATED STOP VALVE	JEA80AA101	NB 15
				JEA80AA106	
			MANUALLY OPERATED STOP VALVE	JEA80AA104	NB 20
			SAFETY VALVE	JEA80AA901	NB 15
			MANUALLY OPERATED FLANGE STOP VALVE	JEA80AA103	NB 15

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
4	JEA50	R01.KK34.30/40UMA.JEA50.TM.OK.WD002-rev0	MANUALLY OPERATED BELLOW STOP VALVE	JEA80AA102	NB 15
			MANUALLY OPERATED BELLOW STOP VALVE	JEA80AA105	NB 15
			MANUALLY OPERATED BELLOW STOP VALVE	JEA81AA101	NB 15
				JEA82AA101	
				JEA83AA101	
				JEA84AA101	
5	LCN	R01.KK34.30/40UMA.LCN.TM.OK.WD001-rev0	MANUALLY OPERATED BELLOW STOP VALVE WITH LOCK	LCN01AA401	NB 20
				LCN01AA402	
				LCN02AA401	
				LCN02AA402	
				LCN03AA401	
				LCN03AA402	
				LCN04AA401	
				LCN04AA402	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA105	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	LCT52AA105	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	LCT53AA105	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA103	NB 10
				LCT52AA103	
				LCT53AA103	
			SAFETY VALVE	LCT51AA901	NB15/25
				LCT52AA901	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
6	LCS	R01.KK34.30/40UMA.LCS.TM.OK.WD001-rev0		LCT53AA901	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA104	NB 15
				LCT52AA104	
				LCT53AA104	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA107	NB 15
				LCT52AA107	
				LCT53AA107	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA106	NB 15
				LCT52AA106	
				LCT53AA106	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA102	NB 10
				LCT52AA102	
				LCT53AA102	
			MANUALLY OPERATED BELLOW STOP VALVE	LCT51AA108	NB 15
				LCT52AA108	
				LCT53AA108	
7	QUB	R01.KK34.30/40UMA.QUB.TM.OK.WD001-rev0	BELLOWS MANUAL GATE	QUB10AA101	NB 10
				QUB10AA102	
				QUB10AA103	
				QUB20AA101	
				QUB20AA102	
				QUB20AA103	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
				QUB30AA101	
				QUB30AA102	
				QUB30AA103	
				QUB40AA101	
				QUB40AA102	
				QUB40AA103	
8	LDB	R01.KK34.30/40UMA.LDB.TM.OK.WD001-rev0	MANUALLY OPERATED CHECK GATE	LDB10AA601 LDB10AA602	DN 250
			BUTTERFLY GATE WITH ELECTRIC DRIVE	LDB10AA003 LDB10AA004	DN 250
			MOTOR OPERATED FLANGED WEDGE GATE VALVE	LDB10AA010 LDB10AA011 LDB10AA012 LDB10AA013	DN 150
			BUTTERFLY GATE WITH ELECTRIC DRIVE	LAB10AA008	DN 150
			MANUALLY OPERATED FLANGED WEDGE GATE VALVE	LDB10AA102 LDB10AA106 LDB10AA111 LDB10AA112	DN 100
			MANUALLY OPERATED STRAIGHT FLOW STOP VALVE	LDB10AA103 LDB10AA104 LDB10AA116 LDB10AA117	DN 100
			MOTOR OPERATED FLANGED WEDGE GATE VALVE	LDB10AA107 LDB10AA114 LDB10AA120	DN 80
			MANUALLY OPERATED STOP VALVE	LAB10AA142	DN 10
			MANUALLY OPERATED FLANGED WEDGE GATE VALVE	LAB10AA134	DN 200
			MANUALLY OPERATED STOP VALVE	LDB10AA110 LDB10AA113 LDB10AA123 LDB10AA126	DN 50
			MANUALLY OPERATED STOP VALVE	LDB10AA108 LDB10AA109 LDB10AA121 LDB10AA122	DN 10
			MANUALLY OPERATED BELLOWS STOP VALVE	LAB10AA138	DN 15
			MANUALLY OPERATED STOP VALVE	LDB10AA144	DN 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA405 LDB10AA406	DN 20
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA401 LDB10AA403	DN25
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA402 LDB10AA404 LDB10AA407	DN50

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA408	DN 20
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA409	DN 20
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA411	DN 20
			MANUALLY OPERATED FLANGED WEDGE GATE VALVE	LDB10AA131	DN 100
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA412	DN 15
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA410	DN 16
			ROTATING CHECK VALVE	LDB10AA605	DN 50
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA133	DN 50
			MANUALLY OPERATED BELLOWS STOP VALVE	LDB10AA105 LDB10AA118	DN 50
			BUTTERFLY VALVE DRIVE WITH MATCHING FLANGES	LDB10AA603	DN 150
			MOTOR OPERATED FLANGED WEDGE GATE VALVE	LDB10AA014	DN 250
			MOTOR OPERATED FLANGED WEDGE GATE VALVE	LDB10AA005	DN 150
			BUTTERFLY GATE WITH ELECTRIC DRIVE	LDB10AA001 LDB10AA002	DN 250
9	LDF	R01.KK34.30/40UMA.LDF.TM.OK.WD001-rev0	ELECTRICALLY OPERATED FLANGED WEDGE RISING STEM GATE VALVE	LDF10AA001 LDF10AA002 LDF10AA007	DN 800
			MOTOR OPERATED REGULATION VALVE	LDF10AA201	DN 800
			ELECTRICALLY OPERATED FLANGED WEDGE GATE VALVE	LDF11AA001 LDF12AA001 LDF13AA001 LDF14AA001	DN 400
			ELECTRICALLY OPERATED FLANGED WEDGE GATE VALVE	LDF11AA002 LDF12AA002 LDF13AA002 LDF14AA002	DN 400
			ELECTRICALLY OPERATED FLANGED WEDGE GATE VALVE	LDF21AA001 LDF22AA001 LDF23AA001 LDF24AA001	DN 400
			MANUALLY OPERATED CONTROL VALVE	LDF10AA201	DN 100
			MANUALLY OPERATED BELLOWS STOP VALVE	LDF10AA402 LDF10AA403 LDF10AA404	DN 50
			MANUALLY OPERATED BELLOWS STOP VALVE	LDF13AA401 LDF14AA401 LDF21AA401 LDF22AA401	DN 32
			MANUALLY OPERATED BELLOWS STOP VALVE	LDF24AA405	DN 20

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
		R01.KK34.30/40UMA.LDP.TM.OK.WD001-rev0	ELECTRICALLY OPERATED FLANGED WEDGE GATE VALVE	LDP50AA008 LDP50AA009	DN 200
			WEDGE GATE VALVE WITH RISING STEM	LDP50AA001 LDP50AA002	DN 150
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP50AA108 LDP50AA111	DN 100
			FLANGED ROTATING CHECK VALVE	LDP50AA601 LDP50AA602	DN 150
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP50AA104 LDP50AA110	DN 150
			MOTOR OPERATED CONTROL VALVE	LDP50AA202	DN 100
			MOTOR OPERATED CONTROL VALVE	LDP50AA204	DN 150
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP10AA123 LDP10AA128 LDP10AA136 LDP20AA119	DN 100
			MOTOR OPERATED CONTROL VALVE	LDP50AA205	DN 100
			FLANGED BACKWATER GATE WITH MATCHING FLANGES	LDP50AA606	DN 100
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP10AA127 LDP20AA123	DN 150
			MANUALLY OPERATED FLANGED DISK GATE	LDP10AA140	DN 150
			MANUALLY OPERATED FLANGED DISK GATE	LDP10AA150 LDP10AA151	DN 100
			MANUALLY OPERATED FLANGED DISK GATE	LDP10AA118 LDP10AA119 LDP10AA120 LDP20AA117	DN 150
			MANUALLY OPERATED FLANGED DISK GATE	LDP20AA121 LDP20AA120 LDP10AA124 LDP10AA121	DN 100
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP20AA132 LDP10AA135 LDP30AA124	DN 100
			MANUALLY OPERATED FLANGED RISING STEM WEDGE GATE VALVE	LDP30AA132	DN 150
			MANUALLY OPERATED FLANGED WEDGE RISING STEM GATE VALVE	LDP31AA104	DN 80
			MANUALLY OPERATED BALL VALVE WITH A LOCK	LDP31AA411	DN 15
			MANUALLY OPERATED BALL VALVE WITH A LOCK	LDP00AA409	DN 15
				LDP00AA410	
			MANUALLY OPERATED STOP VALVE	LDP10AA107	DN 32

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
10	LDP		[illegible]	LDP10AA108	[illegible]
			MANUALLY OPERATED BELLOWS STOP VALVE	LDP10AA103	DN 50
				LDP10AA105	
			MANUALLY OPERATED STOP VALVE	LDP10AA109	DN 25
				LDP10AA110	
			MANUALLY OPERATED BELLOWS STOP VALVE	LDP10AA101	DN 32
				LDP10AA102	
			MANUALLY OPERATED FLANGED STOP VALVE	LDP10AA104	DN 25
				LDP10AA106	
				LDP10AA111	
				LDP10AA112	
			MANUALLY OPERATED FLANGED STOP VALVE	LDP10AA113	DN 25
				LDP10AA114	
				LDP10AA115	
			CHECK VALVE	LDP10AA601	DN 25
			MANUALLY OPERATED BELLOW STOP VALVE WITH A LOCK	LDP00AA106	DN 15
			MANUALLY OPERATED BALL VALVE WITH A LOCK	LDP00AA402	DN 15
			MANUALLY OPERATED BELLOW STOP VALVE WITH A LOCK	LDP20AA103	DN 50
				LDP20AA105	
				LDP20AA107	
				LDP20AA108	
			MANUALLY OPERATED STOP VALVE	LDP20AA109	DN 25

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
		R01.KK34.30/40UMA.LDP.TM.OK.WD002-rev0		LDP20AA110	
			MANUALLY OPERATED BELLOW STOP VALVE	LDP20AA101	DN 32
				LDP20AA102	
			MANUALLY OPERATED FLANGED STOP VALVE	LDP20AA104	DN 25
				LDP20AA106	
				LDP20AA111	
				LDP20AA112	
			MANUALLY OPERATED FLANGED STOP VALVE	LDP20AA113	DN 25
				LDP20AA114	
				LDP20AA115	
			CHECK VALVE	LDP20AA601	DN 25
			MANUALLY OPERATED BELLOW STOP VALVE WITH A LOCK	LDP00AA407	DN 15
			MANUALLY OPERATED FLANGED STOP VALVE	LDP10AA129	DN 50
				LDP10AA125	
				LDP10AA119	
			MANUALLY OPERATED FLANGED STOP VALVE	LDP30AA127	DN 50
			MANUALLY OPERATED REGULATING VALVE	LDP30AA201	DN 50
			MANUALLY OPERATED BALL VALVE WITH A LOCK	LDP00AA403	DN 15
				LDP00AA404	
			MANUALLY OPERATED BELLOW STOP VALVE	LDP20AA139	DN 10
			MANUALLY OPERATED BELLOW STOP VALVE	LDP20AA138	DN 10
			MANUALLY OPERATED BALL VALVE WITH A LOCK	LDP00AA408	DN 15

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			MANUALLY OPERATED FLANGED BALL COCK	LDP10AA139	DN 50
				LDP10AA138	
			MANUALLY OPERATED FLANGED BALL COCK	LDP20AA136	DN 50
				LDP20AA137	
			MANUALLY OPERATED FLANGED BALL COCK	LDP40AA101	DN 50
				LDP40AA102	
				LDP40AA103	
				LDP40AA104	
			ROTATING CHECK VALVE	LDP40AA601	DN 50
				LDP40AA602	
11	LDR	R01.KK34.30/40UMA.LDR.TM.OK.WD001-rev0	ROTATING CHECK VALVE	LDR30AA603 LDR30AA604	DN 80
			MANUALLY OPERATED FLANGED WEDGE RISING STEM GATE VALVE	LDR40AA106 LDR40AA108 LDR40AA109 LDR40AA110	DN 100
			ROTATING CHECK VALVE	LDR40AA601 LDR40AA602 LDR30AA601 LDR30AA602	DN 100
			MANUALLY OPERATED STRAIGHT FLOW STOP VALVE	LDR30AA109 LDR30AA111 LDR30AA113 LDR30AA114	DN 80
			MANUALLY OPERATED BELLOWS STOP VALVE WITH WELDED CONNECTION	LDR40AA112 LDR30AA116	DN 10
			MANUALLY OPERATED BALL CONNECTING PIPE COCK	LDR20AA401 LDR20AA402 LDR40AA404 LDR40AA405	DN 20
			SWING CHECK VALVE WITH RESPONSE FLANGES MADE OF STAINLESS STEEL WITH BRACING	LDR20AA603	DN 100
			MANUALLY OPERATED BALL VALVE	LDR30AA115	DN 80
			BALL VALVE	LDR30AA130	DN 80
			MANUALLY OPERATED DISC GATE VALVE	PGB85AA101 PGB85AA104 PGB85AA107 PGB85AA110	NB 100
			MANUALLY OPERATED VALVE	PGB92AA101 PGB92AA104	NB 65
			MANUALLY OPERATED DISC GATE VALVE	PGB93AA101 PGB93AA104 PGB94AA101 PGB94AA104	NB 65

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
12	PGB84	R01.KK34.40UMA.PGB84.TM.OK.WD001	MANUALLY OPERATED CONTROL VALVE	PGB85AA102 PGB85AA105 PGB85AA108 PGB85AA111	NB 100
			MANUALLY OPERATED DISC GATE VALVE	PGB85AA103 PGB85AA106 PGB85AA109 PGB85AA112	NB 100
			MANUALLY OPERATED CONTROL GATE VALVE	PGB90AA201	NB 150
			MANUALLY OPERATED DISC GATE VALVE	PGB90AA105 PGB90AA106 PGB90AA107	NB 150
			MANUALLY OPERATED STOP VALVE	PGB80AA101	NB 50
			CHECK VALVE	PGB80AA601	NB 50
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	PGB80AA001	NB 25
			MANUALLY OPERATED CONTROL VALVE	PGB93AA102 PGB93AA105 PGB94AA102 PGB94AA105	NB 65
			MANUALLY OPERATED WITH COUNTER FLANGES	PGB93AA103 PGB93AA106 PGB94AA103 PGB94AA106	NB 65
			MANUALLY OPERATED CONTROL VALVE	PGB89AA102 PGB89AA105	NB 65
			MANUALLY OPERATED VALVE	PGB92AA103 PGB92AA106	NB 65
			SAFETY VALVE	PGB85AA901 PGB85AA902 PGB85AA903 PGB85AA904	NB 15/25
			MANUALLY OPERATED BELLOWS STOP VALVE	PGB80AA401 PGB80AA402	NB 50
			MANUALLY OPERATED BELLOW STOP VALVE	QUC20AA101	NB10
				QUC20AA102	
				QUC20AA103	
			MANUALLY OPERATED BELLOW STOP VALVE	QUC40AA101	NB10
				QUC40AA102	
				QUC40AA103	
			MANUALLY OPERATED BELLOW STOP VALVE	QUC31AA101	NB 15
				QUC32AA101	
				QUC33AA101	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
13	QUC	R01.KK34.30/40UMA.QUC.TM.OK.WD001-rev0		QUC34AA101	
				QUC35AA101	
				QUC36AA101	
			BELLOWS MANUAL GATE	QUC31AA102	NB 10
				QUC32AA102	
				QUC33AA102	
				QUC34AA102	
				QUC35AA102	
				QUC36AA102	
			BELLOWS MANUAL GATE	QUC31AA103	NB 10
				QUC32AA103	
				QUC33AA103	
				QUC34AA103	
				QUC35AA103	
				QUC36AA103	
			MANUALLY OPERATED BELLOW STOP VALVE	QUC10AA101	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUC00AA101	NB 10
14	QUG	R01.KK34.30/40UMA.QUG.TM.OK.WD001-rev0	BELLOW MANUALLY GATE	QUG10AA101	NB 10
				QUG20AA101	
				QUG30AA101	
				QUG40AA101	
				QUG50AA101	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
[illegible]	[illegible]	[illegible]	SHAT OFF VALVE BELLOW MANUALLY	QUG11AA101	NB 10
				QUG12AA101	
				QUG13AA101	
				QUG14AA101	
				QUG15AA101	
15	QUH	R01.KK34.30/40UMA.QUH.TM.OK.WD001-rev0	MANUALLY OPERATED BELLOW STOP VALVE	QUH30AA101	NB 10
			REGULATING VALVE	QUH30AA201	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH30AA102	NB 10
			REGULATING VALVE	QUH50AA201	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH50AA101	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH50AA102	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH60AA101	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH60AA102	NB 10
			MANUALLY OPERATED BELLOW STOP VALVE	QUH70AA101	NB 10
				QUH70AA102	
16	LAA	R01.KK34.30/40UMA.LAA.TM.OK.WD001-rev0	MANUALLY OPERATED BELLOW STOP VALVE	LAA10AA101	NB 150
				LAA10AA102	
			MANUALLY OPERATED BELLOW STOP VALVE	LAA10AA103	NB 10
				LAA10AA104	
				LAA10AA105	
			ELECTRICALLY OPERATED GATE VALVE	LAA10AA002	NB 200
			MOTOR OPERATED BELLOW STOP VALVE	LAA10AA001	NB 80

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
		R01.KK34.30/40UMA.LAB.TM.OK.WD001-rev0	ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB05AA001	NB 800
				LAB06AA001	
			MOTOR OPERATED BELLOW STOP VALVE	LAB05AA005	NB 50
				LAB06AA005	
			MANUALLY OPERATED ISOLATION VALVE WITH LOCK	LAB05AA401	NB 50
				LAB06AA401	
			SAFETY VALVE	LAB05AA901	NB 15/25
				LAB06AA901	
			MANUALLY OPERATED ISOLATION VALVE WITH LOCK	LAB05AA402	NB 15
				LAB06AA402	
			MOTOR OPERATED GATE VALVE	LAB07AA001	NB 400
				LAB08AA001	
			MOTOR OPERATED BELLOW STOP VALVE	LAB07AA005	NB 50
				LAB08AA005	
			SAFETY VALVE	LAB07AA901	NB 15/25
				LAB08AA901	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB05AA002	NB 500
				LAB05AA003	
				LAB06AA002	
				LAB06AA003	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB17AA001	NB 500
				LAB18AA001	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB09AA001	NB 150
				LAB10AA001	
				LAB11AA001	
				LAB12AA001	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB10AA002	NB 300
				LAB12AA002	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB16AA001	NB 300
				LAB16AA002	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB21AA003	NB 200
			ELECTRICALLY OPERATED REGULATING VALVE	LAB21AA203	NB 500
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LAB21AA004	NB 50
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LAB17AA101	NB 25
				LAB18AA101	
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LAB05AA101	NB 25
				LAB06AA101	
				LAB05AA102	
				LAB06AA102	
			ELECTRICALLY OPERATED BELLOWS STOP VALVE	LAB17AA102	NB 25
				LAB18AA102	
				LAB10AA403	
				LAB10AA404	
				LAB11AA401	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
17	LAB		ELECTRICALLY OPERATED STOP VALVE	LAB11AA402	NB 32
				LAB17AA410	
				LAB17AA411	
				LAB18AA410	
				LAB18AA411	
				LAB06AA403	
				LAB06AA404	
				LAB21AA413	
				LAB21AA414	
			MANUALLY OPERATED STOP VALVE	LAB10AA401	NB 25
				LAB10AA402	
				LAB05AA403	
				LAB05AA404	
				LAB06AA405	
				LAB06AA406	
				LAB06AA407	
				LAB06AA408	
			CHECK VALVE	LAB07AA601	NB 400
				LAB08AA601	
			MOTOR OPERATED CONTROL VALVE	LAB07AA201	NB 400
				LAB08AA201	
				LAB07AA002	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
		R01.KK34.30/40UMA.LAB.TM.OK.WD002-rev0	ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB08AA002	NB 400
				LAB07AA003	
				LAB08AA003	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB13AA001	NB 200
				LAB14AA001	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB145AA001	NB 400
			MANUALLY OPERATED BELLOWS STOP VALVE	LAB07AA101	NB 25
				LAB08AA101	
				LAB07AA102	
				LAB08AA102	
				LAB07AA401	
				LAB08AA401	
				LAB07AA402	
				LAB08AA402	
			MANUALLY OPERATED STOP VALVE	LAB13AA401	NB 10
				LAB14AA401	
				LAB13AA402	
				LAB14AA402	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB17AA004	NB 500
				LAB18AA004	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB19AA001	NB 400
				LAB20AA001	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB30AA001	NB 400
				LAB40AA001	
				LAB50AA001	
				LAB60AA001	
			MOTOR OPERATED CONTROL VALVE	LAB30AA201	NB 400
				LAB40AA201	
				LAB50AA201	
				LAB60AA201	
			ELECTRICALLY OPERATED WEDGE GATE VALVE	LAB31AA002	NB 100
				LAB41AA002	
				LAB51AA002	
				LAB61AA002	
				LAB31AA001	
				LAB41AA001	
				LAB51AA001	
				LAB61AA001	
			CHECK VALVE	LAB31AA601	NB 100
				LAB41AA601	
				LAB51AA601	
				LAB61AA601	
			REGULATING VALVE WITH ELECTRIC DRIVE	LAB31AA201	NB 100
				LAB41AA201	

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			[illegible]	LAB51AA201	
				LAB61AA201	
			MANUALLY OPERATED STOP VALVE	LAB17AA102	NB 25
				LAB18AA102	
			CHECK VALVE	LAB17AA601	NB 25
				LAB18AA601	
				LAB17AA602	
				LAB18AA602	
			MANUALLY OPERATED STOP VALVE	LAB30AA401	NB 32
				LAB40AA401	
				LAB50AA401	
				LAB60AA401	
				LAB30AA402	
				LAB40AA402	
				LAB50AA402	
				LAB60AA402	
			MANUALLY OPERATED STOP VALVE	LAB21AA111	NB 250
		R01.KK34.30/40UMA.LAB.TM.OK.WD003-rev0	MANUALLY OPERATED BELLOW STOP VALVE WITH LOCK	LAB05AA405	NB 25
				LAB05AA406	
				LAB06AA409	
				LAB06AA410	
			CHECK VALVE	LAC30AA601	NB 25

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
18	LAC	R01.KK34.30/40UMA.LAC.TM.OK.WD001-rev0		LAC40AA601	
			MANUALLY OPERATED BELLOW STOP VALVE	LAC30AA106	NB 25
				LAC40AA106	
			CHECK VALVE	LAC15AA601	NB 50
				LAC25AA601	
				LAC16AA601	
				LAC26AA601	
			MANUALLY OPERATED STOP VALVE	LAC15AA102	NB 50
				LAC25AA102	
				LAC16AA102	
				LAC26AA102	
		R01.KK34.30/40UMA.LAC.TM.OK.WD002-rev0	ELECTRICALLY OPERATED BELLOW STOP VALVE	LAB05AA004	NB 15
				LAB06AA004	
			ELECTRICALLY OPERATED BELLOW STOP VALVE	LAH03AA001	NB 15
			ELECTRICALLY OPERATED BELLOW STOP VALVE	LAB07AA004	NB 15
				LAB08AA004	
			MANUALLY OPERATED STOP VALVE WITH A LOCK	LAB05AA104	NB 15
				LAB06AA104	
				LAB05AA105	
				LAB06AA105	
			OPERATED BELLOW STOP VALVE	LAH03AA101	NB 20
			STOP VALVE WITH ELECTROMAGNETIC DRIVE	LAB07AA014	NB 20

ANNEXURE VI

LIST OF VALVES

SL.NO	SYSTEM KKS	WD REFERENCE	DESCRIPTION	VALVE TAG NO.	VALVE SIZE
			[illegible]	LAB08AA014	
			MANUALLY OPERATED STOP VALVE WITH A LOCK	LAB05AA103	NB 20
				LAB06AA103	
19	LAH	R01.KK34.30/40UMA.LAH.TM.OK.WD001-rev0	WEDGE VALVE GATE WITH HAND DRIVE	LAH01AA101	NB 200
			BELLOWS ISOLATION VALVE WITH HAND DRIVE	LAH01AA401	NB 20
			SAFETY VALVE	LAH01AA901	NB 15/25
			BELLOWS ISOLATION VALVE WITH HAND DRIVE WITH A LOCK	LAH04AA102 LAH04AA103	NB 50
			CHECK VALVE	LAH04AA601	NB 80
			BELLOWS ISOLATION VALVE WITH HAND DRIVE	LAH04AA104 LAH04AA105	NB 20
		R01.KK34.30/40UMA.LAH.TM.OK.WD002-rev0	CHECK VALVE	LAH02AA601	NB 150
			ELECTRICALLY DRIVEN GATE VALVE	LAH02AA001	NB 150
			ELECTRICALLY DRIVEN GATE VALVE	LAH05AA001	NB 100
			ELECTRICALLY DRIVEN CONTROL VALVE	LAH05AA201	NB 100
			ELECTRICALLY DRIVEN GATE VALVE	LAH04AA001	NB 100
			MANUALLY OPERATED BELLOWS STOP VALVE	LAH04AA101	NB 80
			BELLOWS ISOLATION VALVE WITH HAND DRIVE	LAH02AA401 LAH02AA402	NB 10
20	LAJ	R01.KK34.30/40UMA.LAJ.TM.OK.WD001-rev0	MANUALLY OPERATED BELLOWS STOP VALVE	LAJ01AA101	NB 50
			CHECK VALVE	LAJ01AA601	NB 50
			SAFETY VALVE	LAJ01AA901	NB 25/25
21	QUA	R01.KK34.30/40UMA.QUA.TM.OK.WD001-rev0	MANUALLY OPERATED BELLOWS STOP VALVE	QUA20AA101 QUA20AA102 QUA20AA104	DN 10
			MANUALLY OPERATED BELLOWS STOP VALVE	QUA10AA111 QUA10AA112 QUA10AA102	DN 10
			MANUALLY OPERATED BELLOWS STOP VALVE	QUA20AA103 QUA10AA103	DN 10

ANNEXURE – VII
ROOT GAP

	Prepared by	Reviewed by		Approved by	Issued by
Name	Kartik P	Muhammed Quraish	Shashi Kant	S.N Naik	R Thanasekaran
Designation	Dy.Manager	Section Head	Head -QA	Site In-charge	Document Controller
Signature					
Date	07.07.22	07.07.22	07.07.22	07.07.22	07.07.22

ANNEXURE VII

TABLE FOR ROOT GAP

SL.NO	SYSTEM KKS	WD REFERENCE	Diameter (NB)	Fit up Referance Standard	Type of weld	ROOT GAP
1	LCP	R01.KK34.30/40UMA.LCP.TM.OK.WD001-rev0	10/15/20/25/32/50	OST 34-10-417-90	C-23	1-2 mm
			80/100/150/200/250/350	OST 34-10-417-90	C-42	0-0.3 mm
		R01.KK34.30/40UMA.LCP.TM.OK.WD002-rev0	10/15/20/25/32/50	OST 34-10-417-90	C-23	1-2 mm
			80/100/150/200/250/350	OST 34-10-417-90	C-42	0-0.3 mm
		R01.KK34.30/40UGZ.LCP.TM.OK.WD002-rev0	25/50	OST 34-10-417-90	C-23	1-2 mm
			80/100/150/200/250	OST 34-10-417-90	C-42	0-0.3 mm
			350	OST 34-10-417-90	C-24-1	1.5-2 mm
2	LDN	R01.KK34.30/40UMA.LDN.TM.OK.WD001-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
			Less than 150	OST 34-42-659-84	C-23	1-2 mm
			Angle butt joint	OST 34-42-670-84	-	
3	LFN	R01.KK34.30/40UMA.LFN.TM.OK.WD001-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
			Greater than 50	OST 34-10-417-90	C-42	0-0.3 mm
			Angle butt joint	OST 34-10-417-90	-	
4	JEA50	R01.KK34.30/40UMA.JEA50.TM.OK.WD001-rev0	18/25/38/57	OST 34-10-417-90	C-23	1-2 mm
		R01.KK34.30/40UMA.JEA50.TM.OK.WD002-rev0	All dia (SS)	OST 24.125.02-89	C-23	0-0.3 mm
			All dia (CS)	OST 24.125.31-89	C-22	0-0.3 mm
5	LCN	R01.KK34.30/40UMA.LCN.TM.OK.WD001-rev0	20/32(SS)	OST 24.125.02-89	C-23	0-0.3 mm
			50/80/100/150(SS)	OST 24.125.02-89	C-42	0-0.3 mm
			20/32/50/80/100(CS)	OST 24.125.31-89	C-23	0-0.3 mm
			150(SS)	OST 24.125.31-89	C-25	0-0.3 mm
6	LCS	R01.KK34.30/40UMA.LCS.TM.OK.WD001-rev0	14/18/32	OST 34-42-659-84	C-23	1-2 mm
			16	OST 24.125.31-89	C-22	0-0.3 mm
			14/32	OST 34-10-417-90	C-23	1-2 mm
7	QUB	R01.KK34.30/40UMA.QUB.TM.OK.WD001-rev0	Less than 50(Pressure Less than 2.2MPa)	OST 34-10-417-90	C-23	1-2 mm
			Less than 50(Pressure Greater than 2.2MPa)	OST 24.125.02-89	C-23	0-0.3 mm
8	LDB	R01.KK34.30/40UMA.LDB.TM.OK.WD001-rev0	Less than 50(SS)	OST 34-10-417-90	C-23	1-2 mm
			Greater than 50(SS)	OST 34-10-417-90	C-42	0-0.3 mm
			For CS	OST 34-42-659-84	C-23	1-2 mm
			Less than 50(SS)	OST 34-10-417-90	C-23	1-2 mm

ANNEXURE VII

TABLE FOR ROOT GAP

SL.NO	SYSTEM KKS	WD REFERENCE	Diameter (NB)	Fit up Reference Standard	Type of weld	ROOT GAP
9	LDF	R01.KK34.30/40UMA.LDF.TM.OK.WD001-rev0	Greater than 50(SS)	OST 34-10-417-90	C-42	0-0.3 mm
			377-NB-630(SS)	OST 34-10-417-90	C-24-1	1.5-2 mm
			Greater than 720(SS)	OST 34-10-417-90	C-17	1-3 mm
			Less than 150(CS)	OST 34-42-659-84	C-23	1-2 mm
			219-NB-630(CS)	OST 34-42-659-84	C-24-1	1-2 mm
			Less than 1620(CS)	OST 34-42-659-84	C-17	1-3 mm
10	LDP	R01.KK34.30/40UMA.LDP.TM.OK.WD001-rev0	10-NB-50	OST 34-10-417-90	C-23	1-2 mm
			Greater than 50	OST 34-10-417-90	C-42	0-0.3 mm
		R01.KK34.30/40UMA.LDP.TM.OK.WD002-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
			Greater than 50	OST 34-10-417-90	C-42	0-0.3 mm
			Less than 150	OST 34-42-659-84	C-23	1-2 mm
11	LDR	R01.KK34.30/40UMA.LDR.TM.OK.WD001-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
			Greater than 50	OST 34-10-417-90	C-42	0-0.3 mm
			Less than 150	OST 34-42-659-84	C-23	1-2 mm
12	PGB 84	R01.KK34.30/40UMA.PGB84.TM.OK.WD001-rev1	25/32/50/65/80/100/150	OST 34-42-659-84	C-23	1-2 mm
			200/350	OST 34-42-659-84	C-24-1	1-2 mm
			25/50	OST 34-10-417-90	C-23	1-2 mm
13	QUC	R01.KK34.30/40UMA.QUC.TM.OK.WD001-rev0	Less than 50(Pressure Less than 2.2MPa)	OST 34-10-417-90	C-23	1-2 mm
			Less than 50(Pressure greater than 2.2MPa)	OST 24.125.02-89	C-23	0-0.3 mm
			For CS	OST 34-42-659-84	C-23	1-2 mm
14	QUG	R01.KK34.30/40UMA.QUG.TM.OK.WD001-rev0	Greater than 50	OST 34-10-417-90	C-42	0-0.3 mm
			Less than 50	OST 34-10-417-90	C-23	1-2 mm
			65	OST 34-42-659-84	C-23	1-2 mm
15	QUH	R01.KK34.30/40UMA.QUH.TM.OK.WD001-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
16	LAA	R01.KK34.30/40UMA.LAA.TM.OK.WD001-rev0	10/80/100/150	OST 34-42-659-84	C-23	1-2 mm
			200/300/600	OST 34-42-659-84	C-24-1	1-2 mm
			10	OST 34-10-417-90	C-23	1-2 mm
		R01.KK34.30/40UMA.LAB.TM.OK.WD001-rev0	15/25/50	OST 34-42-659-84	C-23	1-2 mm
			200/250/300/400/500/600	OST 34-42-659-84	C-24-1	1-2 mm

ANNEXURE VII

TABLE FOR ROOT GAP

SL.NO	SYSTEM KKS	WD REFERENCE	Diameter (NB)	Fit up Reference Standard	Type of weld	ROOT GAP
17	LAB		700/800	OST 34-42-659-84	C-17	1-3 mm
		R01.KK34.30/40UMA.LAB.TM.OK.WD002-rev0	10	OST 24.125.02-89	C-22	0-0.3 mm
			25/32/50	OST 24.125.02-89	C-23	0-0.3 mm
			100/125/150/200/250/300/400/500	OST 24.125.02-89	C-25	0-0.3 mm
			10,25	OST 24.125.02-90	C-23	
			125/250	OST 24.125.02-90	C-42	
		R01.KK34.30/40UMA.LAB.TM.OK.WD003-rev0	530	OST 24.125.31-89	C-25	0-0.3 mm
			57	OST 34-42-659-84	C-23	1-2 mm
18	LAC	R01.KK34.30/40UMA.LAC.TM.OK.WD001-rev0	32/25/18/38	OST 34-42-659-84	C-23	1-2 mm
			25/38	OST 34-10-417-90	C-23	1-2 mm
		R01.KK34.30/40UMA.LAC.TM.OK.WD002-rev0	18/28	OST 24.125.31-89	C-23	0-0.3 mm
			25	OST 24.125.31-89	C-23	0-0.3 mm
		R01.KK34.30/40UMA.LAC.TM.OK.WD003-rev0	25/57	OST 24.125.02-89	C-23	0-0.3 mm
			Less than 50	OST 24.125.11-89	C-23	0.5-1.5 mm
19	LAH	R01.KK34.30/40UMA.LAH.TM.OK.WD001-rev0	15/20/50/150	OST 34-42-659-84	C-23	1-2 mm
			200	OST 34-42-659-84	C-24-1	1-2 mm
			32	OST 34-10-417-90	C-23	1-2 mm
			80	OST 34-10-417-90	C-42	0-0.3 mm
		R01.KK34.30/40UMA.LAH.TM.OK.WD002-rev0	10	OST 24.125.31-89	C-22	0-0.3 mm
			25/80	OST 24.125.31-89	C-23	0-0.3 mm
			100/150/200	OST 24.125.31-89	C-42	0-0.3 mm
			10	OST 34-42-659-84	C-23	1-2 mm
			80	OST 24.125.02-89	C-42	0-0.3 mm
20	LAJ	R01.KK34.30/40UMA.LAJ.TM.OK.WD001-rev0	18/32/38/57	OST 34-42-659-84	C-23	1-2 mm
			57	OST 34-10-417-90	C-23	1-2 mm
21	QUA	R01.KK34.30/40UMA.QUA.TM.OK.WD001-rev0	Less than 50	OST 34-10-417-90	C-23	1-2 mm
			10-NB-50	OST 24.125.31-89	C-23	0-0.3 mm
			6	PNAE G-7-009-89 rev1	C-22	0-0.3 mm

न्यूक्लियर पॉवर कॉर्पोरेशन ऑफ इंडिया लिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
(भारत सरकार का उद्यम A Govt. of India Enterprise)
कुडनकुलम न्यूक्लियर पॉवर प्रोजेक्ट KUDANKULAM NUCLEAR POWER PROJECT- 3&4

Kudankulam Nuclear Power Project-3 & 4
DOCUMENTATION CENTRE
KK-3 & 4/T/S/G-3/0639/00/R1
Date: 16/08/2022

दस्तावेज स्वीकृति सूचना DOCUMENT ACCEPTANCE NOTE

Document No	I 46	KK 34	0	0	QA	QP	WD 026. R01
दस्तावेज शीर्षक Document Title	**Quality Plan for Fabrication, Erection, Welding & NDT of carbon steel piping , valves & supports**						
संविदाकार Contractor	**M/S BHARAT HEAVY ELECTRICALS LIMITED**						
कार्य आदेश सं. Work Order No.	**400442 dated 05.08.2019**						
कार्य का नाम Name of Work	**Erection work of Turbine, Generator, Condenser, Secondary cycle & Sea Water System Equipment's and piping including Painting, Insulation, Anti Corrosive Coating and structural steel works in turbine building and sea water structure of KKNPP 3&4**						

उपर्युक्त दस्तावेज की समीक्षा की गई है और लागू डब्लूडी, कोड और विनिर्देशों की आवश्यकताओं की पुष्टि पाई गई है।
Above document has been reviewed and found conforming to the requirements of applicable WDs, codes and specifications.

गतिविधि Activity	अनुभाग Section	नाम एवं पदनाम Name & Designation	हस्ताक्षर एवं दिनांक Signature & Date
समीक्षित Reviewed by	Mechanical	Uma Shankar Patnaik SO/E	02/08/2022
		K. KANNADHASAN SO/E	2/8/22
सहमत Concurred by	QA	Vasant Bhat SO/E	3/8/22
	FE	Ravindra Penumestha SO/E	P. Ravindra, 05.08.22
स्वीकृत Accepted by	QA	G. Bijin, Head QA	10/8/22

Controlled Copy Distribution List

Sl.No.	Controlled Copy No.	ISSUED TO		
		Department	**Responsible Person**	**Type of Control**
NPCIL				
01	01	NPCIL MECH	ENC/TSS PACKAGE GROUP HEAD	CONTROL COPY
02	02	NPCIL QA	HEAD- QA	CONTROL COPY
03	03	NPCIL FE	HEAD - FE	CONTROL COPY
BHEL				
04	04	BHEL	SITE INCHARGE	CONTROL COPY
05	05	BHEL QA	HEAD- QA	CONTROL COPY
06	06	BHEL DOCUMENTATION	DOCUMENT CONTROLLER	MASTER COPY

	Prepared by	Reviewed by	Approved by	Issued by
Name	ARUN R	SHASHIKANT	S N NAIK	R THANASEKARAN
Designation	Engineer QA	Head-QA	Site-In-Charge	Document Controller
Signature				
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

Revision Status

Rev. No.	Date of 1st Issue/ Rev.	Description
00	29.03.2022	Quality assurance Plan for carbon steel piping's & supports of Secondary cycle system
00	25.04.2022	NPCIL Comments Incorporated
00	10.05.2022	Clause 1. scope modified-CRR, hydro test, painting & CCC deleted Clause 2. Purpose Modified- Hydro test deleted Clause 3. Applicability modified- CRR, hydro test & CCC deleted Clause 4. Reference –Hydro test procedure details deleted, Applicable WDs details added. Sl. No 7.3 Work front takeover clause added Sl. No 8.3 Grit blasting & painting deleted, it is covered in separate QP Sl. No 8.5 Spring Hanger Support details added Sl. No 8.6 Torque tightening clause added Sl. No 13. Hydro test & final completion deleted
01	25.07.2022	QP for Sea water and Secondary cycle CS piping is merged Incorporated NPCIL FE & QA comments
01	01.08.2022	Re submitted after incorporating NPCIL comments

	Prepared by	Reviewed by	Approved by	Issued by
Name	ARUN R	SHASHIKANT	S N NAIK	R THANASEKARAN
Designation	Engineer QA	Head-QA	Site-In-Charge	Document Controller
Signature				
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

CONTENTS

	Prepared by	Reviewed by	Approved by	Issued by
Name	ARUN R	SHASHIKANT	S N NAIK	R THANASEKARAN
Designation	Engineer QA	Head-QA	Site-In-Charge	Document Controller
Signature				
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

1. SCOPE:

This Document provides Quality Assurance Plan for Fabrication, Erection, Welding & NDT of carbon steel piping of KKNPP-3&4 including sea water system under cat-III & QNC. CRR, Hydro test, CCC painting and Insulation are excluded from the scope of this QAP.

2. PURPOSE:

This Quality plan explains the sequence of activities for Fabrication, Welding, Erection, Alignment & NDT statement of Witness and Hold points, for carbon steel piping of KKNPP-3&4 TSS package.

3. APPLICABILITY:

This Quality Plan is applicable for Fabrication, Erection, Welding & NDT of carbon steel piping including sea water piping of KKNPP-3&4, TSS package.

4. REFERENCES:

Sl No.	Doc. No	Description
1	Tender document: No. NPCIL/KK/-3&4/CONST/MECH/PT/2018/56	Technical specification –Section V
2	Relevant working drawings, codes & standards applicable	
3	I46-KK34-0-0-CC-WPR-WD018	Approved Procedure for CS piping of Secondary cycle system
4	I46-KK34-0-0-CC-WPR-WD032	Approved Procedure for CS piping of sea water system
5	SNIP 3.05.05-84	Construction Norms and Rules. Technological equipment and Technological Pipelines.
6	RD-153-34.1-003-01	Welding thermal treatment and control of tube systems of boilers and pipelines during assembly and repair of power engineering equipment.
7	SN-527-80	Introduction of Designing of Technological Steel Pipe-Lines with Pressure up to 10 Mpa
8	I46.KK34.0.0.QA.QFS.WD 003	Work procedure for Dye penetrant testing
9	I46.KK34.0.0.QA.QFS.WD 004	Work procedure for Visual and measuring examination testing

	Prepared by	Reviewed by	Approved by	Issued by
Name	ARUN R	SHASHIKANT	S N NAIK	R THANASEKARAN
Designation	Engineer QA	Head-QA	Site-In-Charge	Document Controller
Signature				
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

10	I46.KK34.0.0.QA.QFS.WD 006	Work procedure for De-preservation and Re-preservation
11	I46.KK34.0.0.QA.WPR.WD 001	Work procedure for Technology certification of welding procedure specification
12	I46.KK34.0.0.QA.QFS.WD 001	Work procedure for certification of welder performance Qualification
13	I46-KK34-0-0-QA-QFS-WD007	Approved Radiography Inspection Procedure
14	I46-KK34-0-0-QA-QFS-WD016	Approved Ultrasonic Inspection Procedure
15	I46.KK34.0.0.QA.QP-WD037	Quality plan for Erection and Alignment of Piping, supports of Carbon Steel Piping.
16	I46.KK34.0.0.CC.WPR.WD 009	Work procedure for mounting of o-lets and thermowell lugs
17	I46.KK34.0.0.CC.WPR.WD005	Work procedure for Foreign Material Exclusion
18	I46.KK34.0.0.QA.QFS.WD005	Work Procedure for Incoming Material Inspection Report
19	I46.KK34.0.0.CC.WPR.WD-021	Work Procedure for Weld / Mechanical Joint Identification and Marking for Equipment and Pipelines
20	I46.KK34.0.0.QA.QFS.WD-031	Work Procedure for Valve testing
21	PNAEG7-003-87	Certification rules for welders of nuclear power plant, equipment and pipe lines
22	PNAEG 7-010-89	Welding joint & Weld surface Inspection Regulations
23	GOST 18442-80	Non-Destructive Testing
24	PNAEG 7-009-89	Welding & Weld surfacing of equipment and applications
25	PNAEG 7-008-89	Regulations for design and safe operation of equipment and pipe lines of Nuclear facilities
26	RD 34-10.030-89	Rules for checking quality of welded joints of Nuclear Power Plant pipelines
27	OST 34-42-659-84	Butt welded joints
28	OST 34-42-670-84	Connecting branches/fillet welded joint
29	ANNEXURE - A	Applicable WDs
30	ANNEXURE - G	Applicable WDs

5. RESPONSIBILITY:

It is the responsibility of BHEL TSS package Site-In-Charge and Head-QA to implement this procedure.

All field Inspection related activities	QA Engineer
Addition / Deletion/Change of Inspection activities	QA Head

6. STATEMENT OF CHECKS

- For checks where log sheets are not called for, suitable records should be maintained in the form of log book/ protocols.
- Abbreviations used in the column "Responsible Agency" are:

P : Performer of the Activity

H : Hold (Advanced intimation shall be given to "HOLD" agency when commencing to that stage & can proceed further only after obtaining clearance)

W : Witness (Prior intimation shall be given to witness agency, wait for representative to witness the activity till prefix time & proceed to next stage. ~~Depending on confidence level, NPCIL may decide to reduce the percentage or waive off witness~~).

10/8/22

S : Surveillance: Surveillance of the activity

2 : Bhel sub agencies

	Prepared by	Reviewed by	Approved by	Issued by
Name	ARUN R	SHASHIKANT	S N NAIK	R THANASEKARAN
Designation	Engineer QA	Head-QA	Site-In-Charge	Document Controller
Signature				
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
1	**INCOMING MATERIAL INSPECTION**												
1.1	Identification of Pipes, Fittings, Valves, Support, Strutural steel materials,welding consumables and other components	Verification of packing slip description, Tag, Quantity, Inspection clearance, Test Certificates and damage (if any),physical condition of material	Critical	Visual, measurement & records	100%	Working Drawings, Packing slip, Passport documents. Test Certificates. Work procedure for IMIR: I46.KK34.0.0.QA.QFS.WD005	Packing slip, Passport documents and Test Certificates	2	Format no: BHEL/KKNPP/3&4/TSS/WP/ 006- F001 & F002	W	H	W	H
1.2	Preservation condition of the materials	Verification of preservation condition as per WD	Critical	Visual	100%	work procedure Depreservation and Represervation : I46.KK34.0.0QA.QFS.WD006	As per manufactures instruction	2	Format no: BHEL/KKNPP/3&4/TSS/WP/ 006- F001 & F002	W	H	W	H
2	**TESTING/MEASURING OF EQUIPMENTS**												
2.1	Calibration of Welding Equipment's & IMTE'	Verification /Each Inspection	Major	Verification/ Review of Calibration certificates	100%	Calibration certificates	Calibration agency shall be accredited by NABL	2	Format no: BHEL/KKNPP-3&4/TSS/FQP/003/F-003	W	H	-	W
3	**DEPRESERVATION**												
3.1	De-preservation of Pipes, Fittings, Valves, Support materials and other components	Removal of preservatives	Minor	Visual	100%	work procedure Depreservation and Represervation : I46.KK34.0.0QA.QFS.WD006	As per manufactures instruction	2	Format no: BHEL/ KKNPP/3&4/TSS/WP/008 /F001	H	W	W	-
4	**CELANLINESS OF PIPES**												
4.1	Ensuring FME check	Absence of Foreign Materials, dust, mud.	Major	Visual	100%	Work procedure for FME: I46.KK34.0.0.CC.WPR.WD005	No Foreign Material shall be found	2	Format no: BHEL/KKNPP-3&4/TSS/WP/014/F-001	W	H	W	S

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
5	**WELDING CONSUMABLES**												
5.1	Identification of welding consumables	Verification of Specification, Size, Quantity, damage, Test certificate, calcination requirement etc.	Major	Visual & Record Verification	100%	Work procedure for IMIR: I46.KK34.0.0.QA.QFS.WD005	Applicable Working Document	2	Format No: BHEL/KKNPP-3&4/TSS/WP/013/F-03	W	H	W	W
6	**CONTROL OF WELDING ACTIVITIES**												
6.1	Welding Procedure Specification and procedure Qualification Record	Welding Parameters,Essential and Non Essential Variables	Critical	Verification of Records,NDT & Mechanical testing	100%	Work procedure for WPS certification :I46.KK34.0.0QA.WPR.WD001,PNAE-G-7-009-89	PNAE-G-07-010-89 PNAE-G-07-016-89	2	Format No: BHEL/KKNPP-3&4/TSS/WP/002/F-004 & 005	-	H	-	H
6.2	Welder Qualification Test	Verification of previous experience, Welder performance and qualification Test	Critical	Visual , Measurement, & NDT	100%	Procedure of certification for welder performance Qualification : I46.KK34.0.0.QA.QFS.WD001,PNAE-G-07-09-089	PNAE-G-07-010-89 PNAE-G-07-003-87	2	Format No: BHEL/ KKNPP 3&4/ TSS/ WP/ 002/ F-02 & F-03	-	H	-	H
7	**PRE-FABRICATION AND ERECTION OF PIPES ACTIVITIES**												
7.1	Marking, cutting, grinding and edge preparation of pipes for pre-fabrication & check pipes internal coatingf for any damage during transit (if applicable)	Check for length and edge groove configuration.	Minor	Visual & measurement	100%	Applicable Working documents and manufacture documents, and OST standard for edge preparation.	As per WD	2	BHEL/KKNPP-3&4/TSS/Piping/18/A	H	W	W	-

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
7.2	Pre-Fabrication Fit- up	Checking of dimensions, slope, orientation, direction, etc. as per isometric/ GAD/ layout/ PID	Minor	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/WP/001/F-001	H	W	W	S
7.3	Taking over of wrok front	check the elevation & flatness of pedestals, bolt holes sizes and depth	major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/FQP/008/F001	W	-	W	-
7.4	Installation of pipe spools,fittings and valves	Terminal points,availability of erection scheme,Ensure elevation,coordinate,slope,orientation and flow direction as per WD Valve tag no., class	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents, Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/Piping/018 /A	W	W	W	-
7.5	Weld Joint fit up & Welding	Ensuring root gap & joint configuration as in WD.Ensuring required process,consumable,Welders and Welding Parameters	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	Applicable WD as per Annexure E & G , applicable OST	2	BHEL/KKNPP-3&4/TSS/WP/001/F-001	W	W	-	W

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
8	PRE-FABRICATION AND ERECTION OF SUPPORT ACTIVITIES												
8.1	Support Pre-fabrication (if Applicable)	Marking,cutting and checking the type of material,Dimension of supports	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/QAP/008/F -007	W	W	W	-
8.2	Support pre-fabrication fitup and welding	Ensuring root gap & joint configuration as in WD.Ensuring required process,consumable,Welders and Welding Parameters	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I43.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/QAP/008/F -007	W	H	W	W
8.3	Support Erection	Identification of EPs for support,erection of Hilti anchors and coordinate as per corresponding WD,Ensuring proper type of support with erction clearance,Torque tightening of bolts,Identification of specified Hilti anchorbolts,torque tightening of Hilti Bolts & the sliding surface shall be cleaned and rubbed with graphite	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/Piping/18/B	W	W	W	-

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
8.4	Support erection fit-up and welding	Ensuring root gap & joint configuration as in WD.Ensuring required process,consumable,Welders and Welding Parameters, Ensuring inside coating after support weld (if applicable)	Major	Visual & measurement	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	BHEL/KKNPP-3&4/TSS/QAP/008/F -005	W	H	W	W
8.5	Spring hanger (If applicable)	Welding of Lug with Embedded plate/structural member Welding of Stopper on pipe for Vertical spring hanger Springs free length need to be checked before erection, Ensure compressed length as per drawing and check the relaesed length after unlocking.	Major	Visual and Dimensional verification	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018	As per WD	2	BHEL/KKNPP-3&4/TSS/QAP/008/F -006	W	W	W	S
8.6	NDT of supports	Checking of weld discontinuities	Major	Visual inspection , Dye penetrant test	As per WD	Applicable WD, OST & PNAE G-07-10-89	PNAE G-07-10-89		Format No: BHEL/KKNPP-3&4/ TSS/ WP/ 004/ F-01 & BHEL/KKNPP-3&4/TSS/WP/001/F-001		W		W
8.7	Torque tightening of supports bolts	calibrated Torque wrench	Major	Visual	100%	Applicable Working documents and manufacture documents,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	These values will be finalised and issued before torque tightening	2	BHEL/KKNPP-3&4/TSS/FQP/008/F -003	W	W	W	S
9	**O-let, Thermowell lugs**												
9.1	Location, orientation,size of instrumentaion lug, o-let	Verification of location of the lug, o-let	Major	Visual & measurement	100%	I46.KK3&4.0.0.CC.WPR.WD009	As per WD	2	Site register	W	W	W	
9.2	Welding of instrumentation lugs, O-lets	Checking of weld discontinuities	Major	Visual inspection , Dye penetrant test	As per WD	I46.KK3&4.0.0.CC.WPR.WD009	Applicable WD, OST & PNAEG-07-10-89	2	Format No: BHEL/KKNPP-3&4/ TSS/ WP/ 004/ F-01 & BHEL/KKNPP-3&4/TSS/WP/001/F-001		W		W

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
10	**WELDING**												
10.1	Weld Joint Fit-up	Checking of Groove Angle, Root Gap, Root face dimension	Major	Visual & measurement	100%	Applicable WD,WPS,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018	Applicable WD,WPS and as per clause 14.1.2 of Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018	2	BHEL/KKNPP-3&4/TSS/WP/001/ F-001	W	H	-	W
10.2	Welding control	Ensure required process,consumables,Qualified welders,purity of argon gas	Critical	Visual & measurement	100%	Applicable WD,WPS,Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018	PNAE-G-07-009-89,PNAE-G-07-010-89,Applicable OST Standard	2	BHEL/KKNPP-3&4/TSS/WP/001/F-001	W	H	-	W
10.3	Final Weld Inspection	Checking of weld size, cleanliness & any other visual weld defects.	Major	verification of record	100%	Work procedure for Visual and measuring:I46.KK3&4.0.0.QA.QFS.WD004	PNEAG-07-10-89, applicable OST standard	2	BHEL/KKNPP-3&4/TSS/QAP/008/F -001	w	H	S	W
11	**FLANGE JOINTS**												
11.1	Physical condition of gasket	Correct size, free from damage	Major	visual	100%	Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	2	Site register	W	W	W	
11.2	Torque tightening of bolts	checking torque value	Major	Visual & measurement	100%	Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per WD	2	Site register	W	W	W	
12	**NDT**												
12.1	Weld visual	weld surface discontinuities	Major	Visual & Measurement	As per WD	Work procedure for Visual and measuring:I46.KK3&4.0.0.QA.QFS.WD004	Applicable OST, PNAE G-07-10-89	2	BHEL/KKNPP-3&4/TSS/WP/001 /F001		H		H
12.2	Liquid Penetration Test	weld surface discontinuities	Major	Visual & Measurement	As per WD	Applicable WD, Work procedure for Dye penetrant testing:I46.KK3&4.0.0.QA.QFS.WD003	PNAE G-07-10-89	2	Format No: BHEL/KKNPP-3&4/ TSS/ WP/ 004/ F-01	-	H	-	W
12.3	Radiographic Testing	Checking of Weld discontinuities	Major	Film interpretation	As per WD	Applicable WD, Work procedure for Radiography testing:I46.KK3&4.0.0.QA.QFS.WD007	PNAE G-07-10-89	2	Format No: BHEL/ KKNPP-3&4/ TSS/ WP/ 005/ F-01	-	H	-	H
12.4	Ultrasonic Testing	Checking of Weld discontinuities	Major	Visual & Measurement	As per WD	I46.KK34-0-0-QA-QFS-WD016	PNAE G-07-10-89	2	BHEL/KKNPP-3&4/TSS/WP/029,F-001	-	H	-	W

Sl no	Description of activity/ operation	Inspection Characteristic	Category of Attribute	Type of check	Quantum Of Check	Reference Document	Acceptance Standard	Task Performer	Format of Record	Responsible Agencies			
										M/s BHEL		M/s NPCIL	
										Exe	QA	Exe	QA
13	**REPAIR OF WELDS**												
13.1	Weld Repair	Repair of weld joints defects after NDT	Major	Visual & Measurement	100%	Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD018 & I46.KK3&4.0.0.CC.WPR.WD032	As per Clause No.14.5.7 of Work Procedure No:I46.KK3&4.0.0.CC.WPR.WD 018 & I46.KK3&4.0.0.CC.WPR.WD032, PNAE G 7-10-89	2	As applicable as per sl no. 12	-	H	-	W
14	**RE PRESERVATION**												
14.1	Re Preservation	Visual cleaning of weld surface and Touch up paint for all Weld area	Minor	Visual and Dimensional verification	100%	work procedure Depreservation and Represervation : I46.KK34.0.0QA.QFS.WD006	Approved WDS and Passpoort copies , work procedure Depreservation and Represervation : I46.KK34.0.0QA.QFS.WD006	2	BHEL KKNPP/3&4/TSS/WP/008 /F002	W	W	W	S

	Prepared by	Reviewed by	Approved by	Issued By
Name	ARUN R	SHASHIKANT	SANJIBA NANDA NAIK	R THANASEKARAN
Signature				
Designation	ENGINEER-QA	HEAD-QA	SITE INCHARGE	DOCUMENT CONTROLLER
Date	01.08.2022	01.08.2022	01.08.2022	01.08.2022

ANNEXURE - A (Sea water piping)

Applicable WDs

SL.NO	SYSTEM KKS	BUILDING	WD REFERENCE
1	**PUL**	**UPX**	**R28.KK34.30/40UPX.PUL.TH.OK.WD001 Rev.0**
2	**PCB**	**UQX**	**R28.KK34.31UQX.PCB.TW.OK.WD001 Rev.0**
			DCN-DSG34-4704-21 & DCN-DSG34-2287-19
			R28.KK34.41UQX.PCB.TW.OK.WD001 Rev.0
			DCN-DSG34-4691-21 & DCN-DSG34-2305-19
3	**PCB**	**UQA**	R28.KK34.30UQA.PCB.TW.OK.WD001 Rev.0
			DCN-DSG34-2051-19
4	**PCB**	**UQA**	**R28.KK34.30UQA.PCB.TW.OK.WD002 Rev.0**
			DCN-DSG34-2357-19, TAR-S-2486
			R28.KK34.40UQA.PCB.TW.OK.WD002 Rev.0
			DCN-DSG34-2404-19, TAR-S-2485
5	**PUK/PUJ**	**UQA**	**R28.KK34.30UQA.PUK.TW.OK.WD001 Rev.0**
			DCN-DSG34-2668-20 & DCN-DSG34-4522-21
			R28.KK34.40UQA.PUK.TW.OK.WD001 Rev.0
			DCN-DSG34-3055-20 & DCN-DSG34-4523-21
6	**PUM**	**UPX**	**R28.KK34.30UPX.PUM.TH.OK.WD001 Rev.0**
			DCN-DSG34-4421-21
			R28.KK34.40UPX.PUM.TH.OK.WD001 Rev.0
			DCN-DSG34-4371-21
7	**PUM**	**UPX**	**R28.KK34.30UPX.PUM.TH.OK.WD002 Rev.0**
			DCN-DSG34-4427-21
			R28.KK34.40UPX.PUM.TH.OK.WD002 Rev.0
			DCN-DSG34-4393-21
8	***PAB89***	***Between UMA and UQA***	***R01.KK34.PAB.TM.OK.WD002***
9	***PGB - Burried***		***R28.KK34.3/4PGB.TM.OK.WD001***

ANNEXURE G- Secondary cycle piping WDs		
Applicable WDs		
SL.NO	SYSTEM KKS	WD REFERENCE
1	PAB	R01.KK34.30/40UMA.PAB90.TM.OK.WD001-rev1
2	PAB	DCN-DSG34-2521-19
3	PAB	DCN-DSG34-2523-19
4	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD001-rev0
5	PAB	DCN-DSG34-335-18
6	PAB	DCN-DSG34-336-18
7	PAB	DCN-DSG34-387-18
8	PAB	DCN-DSG34-388-18
9	PAB	TAR-S-337
10	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD002-rev0
11	PAB	R01.KK34.30/40UMA.PAB.TM.OK.WD003-rev0
12	PAB	DCN-DSG34-831-19
13	PAB	DCN-DSG34-832-19
14	PGB 10	R01.KK34.30/40UMA.PGB10.TM.OK.WD001-rev1
15	PGB 10	TAR-S-2934
16	PGB 10	TAR-S-2938
17	PGB 21	R01.KK34.30/40UMA.PGB21.TM.OK.WD001-rev0
18	PGB 21	DCN-DSG34-732-19
19	PGB 21	DCN-DSG34-733-19
20	PGB 21	R01.KK34.30/40UMA.PGB21.TM.OK.WD002-rev0
21	PGB 21	DCN-DSG34-751-19
22	PGB 21	DCN-DSG34-752-19
23	PGB 40	R01.KK34.30/40UMA.PGB40.TM.OK.WD001-rev0
24	PGB 40	DCN-DSG34-1148-19
25	PGB 80	R01.KK34.30/40UMA.PGB80.TM.OK.WD001-rev1
26	PGB 80	TAR-S-3230
27	PGB 80	TAR-S-3231
28	PGB 84	R01.KK34.30/40UMA.PGB84.TM.OK.WD001-rev1
29	PGB 84	R01.KK34.30/40UMV.PGB84.TM.OK.WD001-rev1
30	PAS	R01.KK34.30/40UMA.PAS.TM.OK.WD001
31	PAS	R524 KK34 30/40UMA PAS TU MC WD001
32	PAS	TAR-S-2411
33	LBG	R01.KK34.30/40UMA.LBG.TM.OK.WD001
34	LBG	DCN-DSG34-440-18
35	LBG	DCN-DSG34-1944-19
36	LBG	DCN-DSG34-441-18
37	LBG	DCN-DSG34-1946-19
38	LBG	TAR-S-2537
39	LBG	TAR-S-2538
40	LBG	R01.KK34.30/40UMA.LBG.TM.OK.WD002
41	LBG	DCN-DSG34-465-18
42	LBG	DCN-DSG34-466-18
43	LCM	R01.KK34.30/40UMA.LCM.TM.OK.WD001