SR. NO.	DESCRIPTION		SPECIFICATION
8.9	Bolts/Stud	:	IS:1363
8.10	Nuts	:	IS : 1363
8.11	Shaft Bearing	:	Leaded Bronze Self Lubricated (BS-1400 LB-2)
8.12	Seat Ring & Clamping Ring	:	SS A 479 Type 304
8.13	Hand Wheel	:	Malleable Iron
8.14	Over Travel Limit Stops	:	Yes
8.15	Mechanical Position Indicator	:	Yes
8.16	Over Travel Limit Stops	:	Yes
8.17	Remote Position Indicator	:	No
8.18	No. of Adjustable Limit Switches	:	Bidder to indicate as per guidelines in Section-I of this volume.
8.19	Hand Pump	:	Yes
8.20	Torque Switches	:	Yes
8.21	Counter Flanges with Bolts, Nuts & Gasket	:	Yes

CONSULTANT : PROCON ENGINEERS

VOLUME III-F

SECTION-4

THERMAL INSULATION

CONSULTANT : PROCON ENGINEERS

CONSULTANT : PROCON ENGINEERS

CONTENTS

CONSULTANT : PROCON ENGINEERS

1.0 GENERAL INFORMATION

1.1 This section of specification covers thermal insulation, cladding sheet and other auxiliary materials required for thermal insulation on piping and equipment.

1.1.1 The thermal insulation shall be applied on the outer surface of equipment, piping, valves, and fittings, having skin temperature more than 60^0C, to conserve the thermal energy and also to maintain the outside surface temperature of the insulation below or at 60°C.

1.1.2 Insulation thickness shall be computed on the basis of the following data :

(a) Design ambient temperature: 45°C

(b) Surface temperature of insulation jacket: 60°C (maximum)

(c) Emissivity of Aluminium sheet: 0.2

(d) Thermal conductivity of insulating material at different temperatures shall be as stipulated in IS: 9842 & IS: 8183 as applicable.

(e) Surface Wind velocity = 0.25 metre/sec

(f) Pipe/Equipment wall temperature=Maximum fluid design temperature

(g) Overall heat transfer coefficient and insulation thickness shall be calculated as per ASTM C 680-89.

The minimum insulation thickness, however, shall not be less than 75 mm for Steam Generator and Electrostatic Precipitator surfaces and 25 mm for other surfaces.

1.1.3 Necessary hydrostatic pressure testing of piping, equipment shall be completed prior to the application of insulation.

1.1.4 All permanent and temporary covering necessary to protect insulation from the weather, shall be supplied and included in Bidder's scope.

1.1.5 Insulation shall not be applied over nameplates of equipment. A neat opening shall be left in the insulation and jacketing around nameplates and the opening suitably flushed to prevent the entrance of moisture.

2.0 CODES AND STANDARDS

In addition to the requirements spelt out in Volume II, all items covered under this section of specification shall conform to the following codes and standards:

2.1	IS-8183	:	Specification for bonded mineral wool.
2.2	IS-3144	:	Methods of test for mineral wool thermal insulation materials.
2.3	IS-3346	:	Methods for the determination of thermal Conductivity of thermal insulation materials (two slab, guarded hot plate method).
2.4	IS-280	:	Mild Steel wire for general engineering purposes
2.5	IS-6528	:	Stainless Steel wire.
2.6	IS-3150	:	Specification for hexagonal wire netting for general purposes.
2.7	IS-4826	:	Hot-dipped galvanised coatings on round steel wires.
2.8	IS-737	:	Specification for sheet and strip of wrought Aluminium and Aluminium Alloys (for General Engineering purposes)
2.9	IS-460	:	Specification for test sieves.
2.10	IS-3677	:	Specification for unbounded rock & slag wool for thermal insulation.

2.11	IS-9842	:	Specification for Preformed Fibrous Pipe Insulation.
2.12	IS-5688	:	Specification for Methods of test for preformed block-type and pipe covering type thermal insulation.
2.13	IS-14164	:	Code of practice for the Industrial Application and Finishing of Thermal insulation material at temperatures above -80°C and up to 750°C.
2.14	ASTM B206	:	Standard specification for Aluminium and Aluminium alloy sheet and plate.

3.0 SCOPE OF WORK

3.1 SCOPE OF SUPPLY

The following materials in required quantities shall be supplied under this section:

3.1.1 Thermal insulating Materials - preformed bonded mineral wool sections, bonded mineral wool mattresses, loose mineral wool and lightly resin bonded glass wool shall be provided.

3.1.2 Hexagonal wire netting of galvanised steel/stainless steel in the form of rolls.

3.1.3 Binding wires, stitching wires and lacing wires of galvanised steel/stainless steel in the form of coils.

3.1.4 Mild steel flats, lugs etc.

3.1.5 Joint sealing compound of self-setting paste type for making cladding joints vapour tight.

3.1.6 Cladding sheets

3.1.7 Cadmium/zinc coated self-tapping type screws with washers for cladding sheet joints.

3.1.8 Heat resistant paints conforming to IS-161.

3.1.9 All other materials i.e. bolts, nuts, rivets, 3 mm thick mill board, aluminium pigment sealant, white glass cloth, insulating cement, neoprene washer etc.

4.0 MATERIALS SPECIFICATIONS

4.1 The insulating materials to be supplied under this specification shall be lightly resin bonded mineral wool of best grade conforming to IS: 8183. Hand made mattresses is not acceptable. Material shall be rock wool only. Slag wool or slag wool inclusion shall not be accepted.

4.2 Lightly resin bonded glass wool mattress, having density 100, Kg/m^3 (min.), self-stitched in shop can also be accepted for temperature less than 400°C and 150 kg/m^3 is to be used for the temperature above 400°C

4.3 The bonded mineral wool shall be secured by means of galvanised steel wire (as per IS 280 or equivalent) of at least 24 SWG in the form of hexagonal netting of 10 mm to 13 mm aperture.

4.4 THE MINERAL WOOL SHALL :

4.4.1 Pass standard combustibility test both immediately after application and after subjected to maximum operating temperature for not less than 100 hrs.

4.4.2 Not suffer permanent deterioration as a result of contact with moisture due to condensation and shall be free from objectionable odour.

4.4.3 Not cause corrosion of the surface being insulated or of cladding on it under normal site conditions.

4.4.4 Not suffer any quality deterioration under specified service conditions (both cold/hot face temperature) of use.

4.5 The mattress insulation shall be machine made, stitched at factory and should retain their form under ordinary handling conditions.

4.6 The Insulation mattress shall be rated incombustible when tested by the method prescribed in clause 15 of IS: 3144 and shall meet the requirement of

the Mercantile Marine department, Lloyd's Register of shipping, fire hazards codes and other International standards.

4.7 Insulation mattress/section shall be supplied in thickness of 25, 40, 50 and 75 mm. Insulation of higher thickness shall be made up in multiple layers using mattress/slabs of thickness specified above. However, if the required thickness is such that by using above mattress/slabs the calculated thickness is not achieved, the mattress/slabs in increment of 5 mm shall be acceptable for outer layers. The minimum thickness however, shall not be less than 25 mm and number of layers shall be minimum and innermost layer shall be thickest.

4.8 Binding and lacing wires shall be provided in line with following :

Sr. No.	Temperature Range	Material	Thickness of wire
(a)	Upto 400°C	Galvanised Steel	20 SWG
(b)	Above 400°C	Stainless Steel	20 SWG

4.9 Sheathing material for all insulated surfaces, equipments, piping etc confirming to ASTM B-209-1060 temper H-14 or IS:737 Gr 19000/H2, shall be provided as per following :

Sr. No.	Bonded Mattress	Lightly bonded	Preformed bonded
(a)	For diameter of insulated surfaces of 450 mm & above and for flat Surfaces	(16 SWG)	With Preformed pipe sections
(b)	For diameter of insulated surfaces upto 450 mm	0.914 mm (20 SWG)	0.914 mm (20 SWG)
(c)	For Steam Generator and ESP outer casing	16 SWG corrugated Aluminium for SG and plain for ESP	

4.10 Straps and bands shall conform to materials as under :

Temperature Range		Material
(a)	Upto 400°C	Galvanized Steel
(b)	Above 400°C	Stainless Steel

Bands shall be 20 mm wide and 0.6 mm thick. For securing aluminium sheathing material, stainless steel or anodized aluminium bends shall be used.

4.11 Screws shall be of galvanized steel, check headed, and self-tapping type. Above 400 degree Celsius temperature, screws shall be stainless steel.

4.12 Hexagonal wire mesh shall be conforming to following:

Temperature Range	Material	Mesh size
(a) Upto 400°C	Galvanized Steel	10-13 mm aperture
(b) Above 400°C	Stainless Steel	-do-

4.13 All other materials e.g. insulation supports, expansion joints, washers etc shall be of standard design of the contractor duly approved by the Owner and/or Consultant.

4.14 Insulating material shall be suitable for the pipe/equipment listed in attached Annexure. For bonded mineral wool insulation, the bonding substance shall retain its binding property upto 600°C.

4.15 The insulating material whether dry or wet shall:

(a) Be fresh, incombustible, rust proof, non hygroscopic and free from asbestos.

(b) Be capable of withstanding continuously and without deterioration the maximum temperature to which it will be subjected.

(c) Not react chemically, either to it or with other components.

(d) Not sustain any fungi or vermin and must not pose health hazards.

5.0 THERMAL INSULATION APPLICATION PROCEDURE

Contractor shall apply thermal insulation at site. Based on Contractor's proven practice and latest design, he will follow his own recommended thermal insulation application procedure. However, the details of method of application and finishing inclusive of all details of insulating materials and supporting arrangements shall be furnished for approval of Owner and /or Consultant.

5.1 GENERAL

5.1.1 All surfaces to be insulated shall be cleaned of all foreign materials such as dirt, grease, rust etc. and shall be dry before the application of insulation.

5.1.2 Before applying the insulation, the contractor shall check that all instrument tapping, clamps, lugs and other connections on the surface to be insulated have been properly installed as per the relevant erection drawing.

5.1.3 The insulation shall be applied to all surfaces when they are at ambient temp. Ample provision shall be made for the maximum possible thermal movement and the insulation shall be applied so as to avoid breaking/ telescoping due to alternate periods of expansion and contraction.

5.1.4 All cracks voids and depressions shall be filled with finishing cement, suitable for the equipment operating temperature so as to form a smooth base for the application of cladding.

5.2 PIPING

5.2.1 Pipe insulation shall be so arranged as to allow for expansion of pipe. Insulation expansion joints shall be provided on all pipelines to allow

movements and expansion of the pipe without producing random cracking of the insulation. The recommended intervals of expansion joints are:

	Pipe Temperature	Spacing of Insulation Expansion Joint
(a)	Upto 200^0 C	5.5 M
(b)	201 - 300^0 C	3.5 M
(c)	301 - 400^0 C	3.0 M
(d)	Above 400^0 C	2.0 M

Before application of any insulating material, it is important to ensure that the surface to be insulated is dry and free from rust, dirt and grease and extraneous matter.

5.2.2 The mattress type insulation shall be formed to fit the pipe and applied with the mattress edges drawn together at the longitudinal joints and secured by lacing wire. Pipe section insulation shall be fitted on pipe using binding wires (tie wires).

5.2.3 Longitudinal joints of insulation mattress sections of horizontal piping shall be on the bottom or at the sides of the pipe.

5.2.4 Where insulation is applied in two or more layers, each layer of mattress shall be backed with hexagonal wire mesh. For the first layer of insulation and in case of single layer insulation, hexagonal wire mesh shall be provided on both the surface of the mattress. For pipe sections, the sections shall be held in place by binding wires without any wire mesh.

5.2.5 The insulation shall be secured to pipes by means of circumferential tie wires of 1.6 mm to 1.0 mm (16 to 19 SWG) for insulation surface with diameter up to and including 550 mm and with metal bends for insulation surfaces with diameter over 550 mm. The fastening shall be done at intervals of 250 mm except where specified otherwise. The ends of the tie wires shall be hooked and embedded in the insulation. The straps shall be mechanically stretched and fastened with metallic clamping seals of the same materials as the strap.

5.2.6 The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation. Any gap in the insulation shall be filled with loose mineral wool or finishing cement.

5.2.7 For multiple layer of insulation, the multiple layers shall be applied so that the circumferential joints on adjacent layers are staggered by at least 150 mm and longitudinal joints by at least 50 mm. At the joint of each layer of insulation, suitable packing material shall be firmly applied where necessary.

5.2.8 Insulation mattress/section ends shall be terminated at a sufficient distance from the flanges to facilitate removal of bolts.

5.2.9 The final layer of insulation shall be backed up by galvanised wire netting stitched with G.I. wire and this shall be anchored to the securing attachments by means of wire ties.

5.2.10 Preformed insulation on vertical or near vertical piping with a difference of elevation of 4 meters or above, must be supported in position by means of metal rings, part rings or studs at intervals not greater than 3.0 m and also immediately above each expansion break in the insulation. The support attachment may be welded or clamped to the pipe subject to approval of the Owner.

5.2.11 The mat insulation for vertical and near vertical piping shall also be suspended from above, and for this purpose securing attachments must be used which may be of metal rings or studs. The confining wire netting of the mattress shall be anchored to the securing attachments by means of wire ties.

5.2.12 Piping bends shall be insulated in the same way as the adjacent straight piping. Where preformed material is used, it should be cut lobster-back fashion and wired and strapped into position.

5.2.13 Insulation for application on bends and elbows shall be cut into mitred segments, sufficiently short to form a reasonably smooth internal surface. After the application of insulation material, insulating cement shall be applied as required to obtain a smooth surface.

5.2.14 Protrusions through insulations, which themselves do not require insulations, such as pipe clamps, supports of small piping (except hanger rods), instrument take-offs, etc., shall be covered to the same thickness as the adjacent insulation.

At outdoor locations and where necessary, the hanger rod protrusions shall be suitably shielded with metal flashing to deflect rain and protect the insulation from moisture while permitting the movement of the hanger rod.

5.2.15 All insulation shall be protected by means of an outer covering of aluminum sheathing. All insulation/cladding joints shall be sealed and made effectively weather and waterproof. All flat surfaces shall be given suitable slope to prevent collection of pools of water on the cladding surface. All sheathing shall be protected internally by the application of two coats of bitumastic paint.

5.2.16 Aluminium sheet jacketing on piping shall be screwed with self- tapping screws on longitudinal joints only. In case of insulating horizontal pipes, these joints shall be arranged approximately 30 Deg. below horizontal centre line to avoid water ingress. The sheets shall be overlapping by 50 mm on both longitudinal and circumferential joints.

5.2.17 Arrangement for securing the metal finish over the insulation shall ensure that direct metal contact between the insulating surface and outer metal cladding is reduced to minimum. All joints shall be vapour tight and shall be able to accommodate thermal movements.

5.2.18 All openings and joints in outdoor cladding for piping connections, supports of access shall be suitably flashed and weatherproofed. Where such flushing or weather-proofing cannot effectively control the entry of moisture, then such openings and joints shall be weather-proofed by application of aluminium pigmented sealer.

5.2.19 For bends, fittings etc. the cladding shall be provided in segments as to ensure a smooth finish of the cladding.

5.2.20 For cladding on vertical pipes/equipment, provision for load take up shall be made at every 2 to 4 meters along pipe/equipment axis.

5.2.21 Galvanic corrosion shall be prevented by carefully avoiding permanent contact of aluminium cladding with copper, copper alloys, tin, lead, nickel or nickel alloys including monel metal.

5.2.22 All joints shall be sealed with acrylic emulsion weather barrier.

5.2.23 Weather hoods shall be provided for insulated piping passing through floors/walls.

5.2.24 Upstream of all drain lines and the lines connected to steam traps, shall be insulated up to and including first isolating valve for heat conservation. Rest of such lines such as downstream of the drain valves, traps etc. and other lines such as safety valve discharges; vents, etc. shall be insulated for personnel protection.

5.3 VALVES AND FLANGES

5.3.1 All valves fittings and specialties shall be insulated with the same type and thickness of insulation as specified for the connected piping with the special provisions and or exceptions as given below.

5.3.2 All valves and flanges shall be provided with removable box type of insulation covered with box fabricated from aluminium sheets of thickness same as the connected pipe cladding. Adjoining pipe insulation shall be bevelled back to permit removal bolts and nuts or bands. The portion of the valve, which cannot be covered by box type insulation, shall be filled by loose insulating material of packing density at least equal to that of the insulating material of adjoining pipe. The insulation for valves/flanges shall be applied after the finishing has been applied over the connected piping. The cladding shall be applied in such a manner that the bonnet flange can be exposed easily without disturbing the complete insulation and cladding.

5.3.3 Removable box type cladding for valves and flanges shall be fitted on the connected pipe cladding, with bands.

5.3.4 Flanges on lines having temperature up to and including 150 Deg.C shall not be insulated.

5.3.5 Union shall not be insulated.

5.3.6 Expansion joints, metallic or rubber, shall not be insulated unless otherwise specifically indicated.

5.3.7 Safety valves shall be insulated.

5.3.8 All flanged joints shall be insulated only after the final tightening and testing.

5.4 EQUIPMENT

5.4.1 Equipment insulation supports shall be welded to the vessel to support vertical insulation. The material of the supports shall be similar to the vessel, as far as practicable. The supports shall be uniformly pitched at 500 mm (approx.). A support shall be located above each vessel flange at a sufficient distance above the flange bolts to allow for easy removal. The top and bottom supports shall be slotted suitably for attachment of straps or wire.

5.4.2 Dished ends of the related equipment shall be insulated by welding studs or cleats to the surface at approximately 300 mm intervals. Insulation application procedure shall be otherwise similar to that for piping.

5.4.3 All longitudinal joints shall have a minimum overlap of 50 mm and shall be located at 45 degree or more below the horizontal for horizontal equipment. Joints shall be made with cheese headed self tapping galvanized steel screws at 150 mm centres.

5.4.4 All circumferential joints shall have a minimum overlap of 100 mm and shall be held in position by stainless steel or anodized aluminium bands, stretched and clamped.

5.4.5 Insulation to various areas shall be applied as under:

	Insulation Area	**Form of Insulation**
(a)	SG and ESP surfaces, hot air and gas ducts	Mineral wool block or Mineral wool blankets.

	(b) All other surfaces (not enclosed as per (a) by boiler casing)	Calcium silicate block or above.

5.4.6 For the Steam Generator furnace, if provided with skin casing and the super heater, reheater and economiser casings where water cooled walls are involved, a first covering of refractory material shall be applied to the external tube surfaces before the application of any further heat resistant insulating material.

5.4.7 The access doors and inspection doors in the Boiler and ESP shall be lined with refractory material. The access doors in other portions of the Steam Generator and ESP shall be insulated in a similar manner corresponding to any casing, flue-ducts or air, ducts where such openings and access doors occur.

5.4.8 While applying mineral wool blanket insulation :

(a) Expended metal or hexagonal wire mesh shall be provided on both sides for single layer mattress and on first layer in case of multilayer insulation. Subsequent layers of multilayer insulation shall have only one side wire netting.

(b) The edges of adjacent blankets shall be leased together, by appropriate lacing wire.

(c) Any gap between joints between insulation layers shall be filled by loose mineral wool confirming to IS: 3677.

(d) All insulation shall be secured by 1.63 mm diameter wire netting over blankets with ends of wire tightly twisted, and pressed in to insulation surface.

(e) Impelling pins shall be placed on centres not exceeding 300 mm.

5.4.9 Aluminium cladding shall not come directly into contact with either the equipment surface or with the supporting arrangement on the equipment surface. To this end, adequate layers of 3 mm thick ceramic board shall be provided between the cladding and any supporting arrangement or

equipment surface, and fitted with self tapping screws/metal bands, as applicable.

5.4.10 Weatherproof flushing shall be installed where the panels intersect with columns and at other similar joints.

5.4.11 Removable insulated covers shall be provided over the Separator manholes.

5.4.12 Cladding on top surface of Steam Generator and ductwork and equipments shall be suitably reinforced to prevent damage by personnel walking thereon.

5.4.13 All cladding for outdoor application shall be with neoprene washers.

5.4.14 Cladding shall have sufficient strength to withstand forces generated in boiler, without any rupture or damage.

5.4.15 Air & Flue Gas ducts with external stiffeners shall have first layer of insulation between the stiffeners and a second layer of insulation over stiffeners so that stiffeners are also insulated and a level surface is achieved.

6.0 DRAWINGS, DATA AND INFORMATION TO BE FURNISHED

6.1 For Drawing, Data and Information required along with BID refer **Volume VIII**.

ANNEXURE – I

LIST OF PIPING SYSTEMS TO BE INSULATED

Thermal insulation supply& application shall include, as a minimum, the following piping together with fittings, valves & specialties:

1.0 Main steam line.

2.0 Cold reheat line.

3.0 Hot reheat line.

4.0 Turbine HP & LP bypass.

5.0 Auxiliary steam lines.

6.0 SH & RH Spray Attemperation lines.

7.0 Boiler Feed suction, discharge, recirculation, leak-off.

8.0 Main Condensate Line.

9.0 Turbine Extraction Lines to different feed water heaters.

10.0 Traced fuel oil supply line.

11.0 Drains & Vents of feed heaters/Deaerator/Flash boxes/G.S. Condenser etc.

12.0 Boiler & Turbine integral pipe work. Line Drains from MS/HR/CR/By Pass /AS etc.

13.0 Steam traced piping.

CONSULTANT : PROCON ENGINEERS

ANNEXURE – II

LIST OF EQUIPMENTS TO BE INSULATED

Thermal insulation supply & application shall include, as a minimum, the following equipments:

1.0 Low pressure and high pressure feed water heaters.

2.0 Deaerating heater.

3.0 Flash tanks, blow down tanks etc.

4.0 Gland steam condenser.

5.0 Boiler feed pumps.

6.0 Electrostatic precipitator.

7.0 Boiler and flue and air ducts.

8.0 HFO heaters and pressurizing pumps.

9.0 Turbine (Both Main and BFPT) (Only spray insulation acceptable).

10.0 Steam traced equipment.

CONSULTANT : PROCON ENGINEERS

ANNEXURE A

MINIMUM TESTING AND INSPECTION REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

CONSULTANT : PROCON ENGINEERS

1.0 GENERAL

The testing and inspections listed herein are the minimum requirements as perceived by the owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.

2.0 H.P.PIPING FOR STEAM GENERATOR, TURBINE AND AUX.

2.1 TESTING OF PIPING AT WORKS

2.1.1 Piping & fittings:

2.1.1.1 All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification.

2.1.1.2 Raw material of all forged/formed fittings shall be ultrasonically tested. All mother pipes used for fitting shall either be ultrasonically tested or hydraulic tested. Forged fittings shall be ultrasonically tested and formed fittings shall be MPI tested.

2.1.1.3 All pipe lengths shall be subjected to 100% ultrasonic examination or hydraulic tests and UT/RT on longitudinal welds at the tube mill.

2.1.1.4 Welded and cast fittings if any shall be subjected to suitable NDT as per applicable standards. However, 100% RT shall be carried out on alloy steel fittings and on carbon steel fittings for use above 71 bar design conditions.

2.1.1.5 The edge preparation for shop and site welds in stainless steel /alloy steel shall be subjected to a dye penetrate check.

2.1.1.6 Thickness of pipe bend shall be checked by ultrasonic or other acceptable methods on sample basis for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination/LPI.
The tests shall be done before fabrication on the piping system and results submitted to Owner/Engineer for approval.

2.1.1.7 Non-destructive examination of welds shall be carried out after post weld heat treatment, if any.

2.1.1.8 For welds in P91, X20 & X22 materials, induction type of heating shall be deployed for heat treatment or heat treatment can be carried out in furnace.

2.1.1.9 Non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met. Further statutory requirement, wherever applicable shall also be complied with.

(a) Temperature > 400 Deg, C and/Or pressure exceeding 71 bar.

(i) 100% RT/UT on butt welds and full penetration branch welds.

(ii) 100% MPE.

(b) Temperature > 175 Deg, C upto 400 Deg. C and/or pressure exceeding 17 bar and upto 71 bar.

(i) 100% RT/UT on butt welds and full penetration branch welds for pipe dia more than 100 NB.

(ii) 10% RT/UT on butt welds and full penetration branch for pipe dia upto 100NB.

(iii) 100% MPE.

(c) 100% UT & 100% MPI on all butt welds of P 91 and X22 UT shall be carried out by digital recorded type.

Wherever SR/PWHT is envisaged, above NDTs shall be after SR/ PWHT.

2.1.1.10 For all other pipes not covered above, shall be subjected 100% MPE/ DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT.

2.1.1.11 Hardness survey of welds shall be carried out on alloy steel/stainless steel piping (100% Hardness survey of welds on P91, X20 & X22 material grade piping) and 3% hardness survey on welds of other alloy steel).

2.1.1.12 Testing of piping at works

All piping shall be subjected to the hydrostatic test pressure at shop as required by the IBR or any other applicable standards. Test pressure shall however be not less than the following:

$$\text{Test Pressure} = 1.5 \times \frac{\text{Allowable Stress at Room Temperature}}{\text{Allowable Stress at Design Temperature}} \times \text{Design Pressure}$$

The Contractor shall guarantee his work as capable of withstanding such hydrostatic tests and consent to repair or replace at his expense any item, which fails to pass such tests at site. Hydrostatic test of all pipes coming under IBR shall be offered for witnessing by the representative of the Inspecting Authority recognised by IBR.

2.1.2 Hangers & Supports:

(a) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

(b) Completed springs shall be tested for Scragging Test & Load vs Deflection Test and for dia. > 25mm MPI shall be carried out.

(c) Each constant load and spring support shall be tested before delivery to ensure that the variation in support capacity provided through the specified ranges (i.e. the difference in load between hot conditions and

cold condition) does not exceed 6 percent for constant load supports and 20 percent for variable spring supports.

(d) Butt Welds shall be tested for UT and fillet welds shall be tested for MPI.

(e) Turn buckle/pipe clamps/Hangers of thickness > 25mm shall be checked by MPI/DPT on bent portion.

2.1.3 Assembled Hangers shall be checked for Variation in deflection and Travel vs Load test and shall meet the requirements of data sheet.

2.1.4 Thermal Insulation & Lagging, Cladding:

(a) Light resign bound mineral wool:

LRB mattresses of Rockwool/Glass wool from approved manufacturing sources confirming to 8183, tested as per relevant clauses of IS 3144 and shall meet the requirements of data sheet. Wire mesh of diameter 0.71 mm (min.) as per data sheet shall only be used.

(b) Lagging & Cladding:

Aluminium sheeting confirming to ASTM B-203-1060 temper H14 from reputed manufacturer meeting the requirements of data sheet.

2.1.5 Valves:

(a) All materials shall be of tested quality and the contractor shall submit the relevant material test certificate for the approval of Owner/ Consultant.

(b) All Valves and Specialties as well as counter flanges to be used in steam service shall have IBR certification marked on them and IBR certificates in appropriate pro-forma shall be submitted.

(c) Pressure retaining parts of valves shall be subjected to (min.) NDT as per Table 1.

(d) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check.

(e) Color matching of valve disc/plug and seat shall be carried out to ensure min. 80% contact and no through passage.

(f) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34/IBR.

(g) Air seat leak test shall be carried out as per applicable Standards/ Codes.

(h) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet

(i) Smooth operation

(ii) Valve travel, closing and opening time.

(iii) Current drawn by actuators.

(i) Springs for safety valves shall be tested with suitable NDT and for spring rate.

(j) Gate valves shall be subjected to shop tests in accordance with API-598 including the high-pressure closure test. Globe valves shall be tested in accordance with BS-1873 and check valves in accordance with BS-1868.

(k) All gaskets used for test shall be of the same material and design as specified for the finished product.

(l) Each relief valve shall be subjected to hydrostatic test, seat pressure test, seat leakage test and test for relieving capacity.

The valve body test pressure shall be at least twice the set pressure.

The seat test pressure shall be at least equal to the set pressure. During this test, the valve seat shall be demonstrated to be watertight for a period of at least two (2) minutes.

2.1.6 Strainers and Traps

(a) All strainers shall be subjected to hydrostatic test. The test pressure shall be twice the design pressure.

(b) All steam traps shall be subjected to hydrostatic test at twice the design pressure. IBR certification shall be furnished for all steam traps.

2.2 TESTS AT SITE

Contractor shall carry out tests at site to prove to the Owner that the equipment of the plant complies with requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run, the Contractor will be required to conduct tests to demonstrate to the Owner that each item of the plant is capable of correctly performing the functions for which it was specified. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows:

2.2.1 All piping, valves and specialties after installation, shall be tested hydraulically at a pressure, one half times that of the maximum attainable pressure in the system or two (2) times the design pressure whichever is higher, to check against leak tightness.

2.2.2 All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.

2.2.3 Visual check on all structural components, welding, painting etc and if doubt arises, these shall be tested again.

2.2.4 All test instruments and equipment shall be furnished by the Bidder to the satisfaction of the Owner.

2.2.5 Checks on electrical items as mentioned in relevant electrical specification.

2.3 PRE-COMMISSIONING TESTING

2.3.1 Alignment Test

After completion of erection and before start-up, alignment test shall be carried out to check levelling, clearance, eccentricity etc. Measurement will be witnessed and acceptance will be certified by the Engineer.

2.3.2 Heat Treatment - All necessary preheating, post heating and stress relieving operation of welds/fabricated items are part of the erection work in accordance with relevant regulations and standard.

All required supervising staff for heat treatment and stress relieving works shall be arranged.

Heat treatment may be required to be carried out at any time during day and night to ensure the continuity of the progress. Supervising staff shall be arranged accordingly.

All data such as heating temperature, heating rate, sparking time, maximum temperature during heat treatment shall be properly recorded. All the data recorded during heat treatment shall be the property of the Owner.

2.3.3 Radiography Test

Radiography tests of all field-welded joints coming under IBR shall be carried, the acceptability standard of which shall be as per IBR. For other field welded joints, radiography or other NDT methods shall be employed as per ASME or equivalent. All radiography shall be carried out in presence of a competent supervisor and his certificate of identification of the films of the radiographs shall be given invariably in all cases.

The repair work shall be suggested immediately after detection of the defective zone to the complete satisfaction of the Engineer. Regarding acceptance of the joints, decision of the Engineer shall be final.

All X-ray films of joints radiographed at site shall become the property of the Owner.

Following optional non-destructive tests after completion of erection of all piping and equipment shall be carried out:

(a) Ultrasonic test per weld joint

(b) Hardness test for 10% weld joints for each system of piping and/or as specified in the approved Field Quality Plan (FQP).

TABLE-1

Valve size NB in mm	**ANSI Class upto 300**	**ANSI Class above 300 upto 600**	**ANSI Class above 600 below 900**	**ANSI Class 900 & above & below 4500**
Less than 50	Visual	Visual	Visual	MPI
50 & above but below 100	Visual	Visual	MPI	MPI & RT (on 10% of valves on 100% area)
100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on change of section & weld ends)	MPI & RT (on 100% area)
300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT on100% area)

CONSULTANT : PROCON ENGINEERS

3.0 LOW PRESSURE PIPING SYSTEM (INCLUDES LARGE DIA CW PIPE)

Items / Components \ Tests/Check		Material Test	DPT/MPI	Ultrasonic Test	WPS/ WQS/PQR	Balancing	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Performance Test	Other Tests	All Tests as per relevant Std	Adhesion/Spark Tests	REMARKS
3.1	Pipes & Fittings and Metered Bends	Y[a]	Y[b]		Y		Y									
3.2	Diaphragm Valves	Y[a]					Y[5]			Y				Y[6]		
3.3	Butterfly Valves (Low Pressure)															
(a)	Cast Butterfly Valves															
	i. Body (Cast)	Y[a]	Y[b]				Y		Y	Y	Y		Y[7]			
	ii. Disc (Cast)	Y[a]	Y[b]													
	iii. Shaft	Y[a]	Y	Y[c]												

CONSULTANT : PROCON ENGINEERS

(b)	Fabricated Butterfly Valves															Ref Note 14
3.4	Gate/ Globe/ Swing Check Valves	Y[a]	Y[b]	Y[c]			Y[5]	Y	Y				Y[8]			
3.5	Dual Plate Check Valves	Y[a]	Y[b]	Y[c]			Y	Y	Y				Y[4]			
3.6	Rolled & Welded Pipes	Y[a]	Y[3]		Y		Y[1]			Y						
3.7	Coating & Wrapping of Pipes	Y[2]											Y[2]			
3.8	Strainers	Y[a]	Y[b]				Y						Y[11]			
3.9	Rubber Expansion Joints	Y[a]					Y[12]		Y	Y			Y[13]			
3.10	Rubber Lining of Pipes	Y[a]	Y[b]		Y		Y			Y				Y[9]	Y	
3.11	Hangers & Supports	Y[a]						Y								
3.12	Fasteners	Y[a]		Y[b]				Y								
3.13	Site Welding		Y[1]		Y		Y									

Notes:

CONSULTANT : PROCON ENGINEERS

1. Weld Joints not subjected to hydraulic test shall be subjected to 100% RT.

2. Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes shall be as per AWWA-C-203-91.

3. DPT on route run and after back gouging and on finish welds.

4. Dry Cycle Test (Spring Cycle Test) for one lac Cycles shall be carried out as a type test.

5. Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.

6. Tests on rubber parts per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.

7. Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with AWWA-C-504 in presence of owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. Seat Leakage Test shall be carried out in both directions.

8. Blue matching, wear travel for gates, valves, pneumatic seat leakage, reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes.

9. Hardness, Bleeding Test and Ozone resistance test shall be done on rubber material.

10. 2% of welds shall be subjected to DPT.

11. Pressure drop across the strainer for each type and size as a special test shall be carried out.

12. During hydraulic and vacuum tests at 25 mm Hg (abs) in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test, permanent set in dimension should not exceed 0.5%.

13. Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149, aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.

14. For fabricated butterfly valves: UT as per ASTM A-435 on plate material for body and disc. 100% RT as per ASTM, Section-VIII, Division-I, on butt joints of body and disc and post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc of thickness above 30mm shall be carried out in addition to other tests indicated for cast butter fly valves.

(a) One per heat/heat treatment batch/lot.

(b) On machined surfaces only for castings and on finished butt welds.

(c) For shaft/spindles > or = 50 mm.

4.0 THERMAL INSULATION

4.1 The Contractor shall furnish test certificates from any one of the independent authorities listed below or any other reputed body subject to Purchase's/ Consultant's prior approval for all the tests as mentioned later.

(a) National Test House - Calcutta/Bombay

(b) Central Glass & Ceramic Research Institute, Calcutta

(c) National Metallurgical Laboratory, Jamshedpur

(d) Central Mechanical Engineering Research Institute, Durgapur

(e) National Physical Laboratory, Delhi

(f) Central Building Research Institute, Roorke, U.P.

(g) Any other internationally reputed Test House.

4.2 The Contractor shall carry out all the tests according to IS: 8183/3144 or according to any other internationally accepted standards. The tests shall be

done on representative samples drawn from the insulating material supplied under this section of specification. All the tests mentioned in IS: 3144 shall be carried out for establishing various chemical and physical properties (as mentioned below) in accordance with the procedure laid down therein. Owner shall have the right to witness any or all of the tests conducted by the contractor at the shop or laboratory.

Following shall be met by testing as per relevant clauses of IS: 3144.

(a)	Shot content	5% by weight (max.), size of any shot not to exceed 5 mm in diameter
(b)	Weight gain by moisture Absorption	2% (max.)
(c)	Sulphur Content	Not exceeding 0.6%
(d)	Alkalinity as Percentage of Na_2O	Not exceeding 0.6%
(e)	Maximum oil content	Not exceeding 0.3% by weight
(f)	Total carbon content	Not exceeding 0.3% by weight
(g)	Settlement	Nil (When tested as per Cl. 21.1 & 21.2 of IS:3144)
(h)	Handability	Fully handable, without any lump formation and disintegration of material
(i)	Loss of weight after	Not exceeding 5% by weight combustibility test

4.3 The Bidder shall furnish the following test reports along with the offer:

(a) Thermal conductivity of the insulating material at various mean temperatures.

(b) Retention of binder at elevated temperature

(c) All other tests as per IS: 9842/8183.

4.4 The Contractor shall guarantee that if, on actual measurement, the specified maximum insulation surface temperatures are exceeded and the contractor shall either replace the insulation with a superior material or provide additional insulation thickness at no extra cost.

VOLUME II

SECTION – 7

QUALITY ASSURANCE REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

CONSULTANT : PROCON ENGINEERS

CONTENT

CONSULTANT : PROCON ENGINEERS

1.0 QUALITY ASSURANCE PROGRAMME

1.1 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme.

1.1.2 Documentation control system.

1.1.3 Qualification data for Bidder's key personnel.

1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

1.1.6 Control of non-conforming items and system for corrective actions.

1.1.7 Inspection and test procedure both for manufacture and all site related works.

1.1.8 Control of calibration and testing of measuring and testing equipments.

1.1.9 System for quality audit.

1.1.10 System for indication and appraisal of inspection status.

1.1.11 System for authorising of release of manufactured product to the Owner.

1.1.12 System for handling storage and delivery.

1.1.13 System for maintenance of records.

1.1.14 Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

2.0 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection /tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

2.2 Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.3 Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.

2.4 The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc as referred

in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal.

2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorised representative and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished.

2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.

2.9 All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

2.10 List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14 For quality assurance of all civil works refer to the specifications for civil works.

3.0 QUALITY ASSURANCE DOCUMENTS

3.1 The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :

3.1.1 Material mill test reports on components as specified by the specification.

3.1.2 The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

3.1.3 Non-destructive examination results/reports including radiography interpretation reports.

3.1.4 Factory tests results for testing required as per applicable codes and standards referred in the specification.

3.1.5 Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.

3.1.6 Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

3.1.7 Stress relief time temperature charts.

3.1.8 Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :

(a) When some important repair work is involved to make the job acceptable.

(b) The repair work remains part of the accepted product quality.

3.2 Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.1 The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.2 The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified Six (6) copies of test reports.

4.3 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.4 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a

certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing.

4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.

FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

Name of Company/ Contractor	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____ Contractor : _____			QP No. : _____ Date _____ Rev. No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remark

FIELD WELDING SCHEDULE

ANNEXURE – B

PROJECT : FWS NO :

CONTRACTOR : REV NO. :

PACKAGE : FIELD WELDING CODE :

SYSTEM : PAGE NO. :

Sl No	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Preheat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks

The Field Welding schedule shall be submitted for:

(a) Pressure Parts

(b) Tanks/Vessels

(c) Piping

(d) Heavy/Important Structural Steel

(e) Heat Exchangers

(f) Bus Ducts

SECTION: I-A

QUALITY ASSURANCE AND INSPECTION REQUIREMENTS

STANDARD CHECL LIST FOR :Insulation & Cladding
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECL LIST NO.:PE-QP-XXX-166-A801
REV.NO. 0
DATE: 31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY				REMARKS
				M	C	N	D	
1.0	Review of Manufacturer's TC for Mineral wool	Sampling as per IS:8183	Appd.Data Sheet/ IS:8183	P	V	V	√	Ref, Note 1
2.0	Review of Material TC for Aluminium sheet	One/Lot	Appd.Data Sheet/ IS:737	P	V	V	√	Ref. Note 2
2.1	Dimensional Check	At random (10%)	-do-	P	V	V	√	
3.0	Packing & Marking	100%	IS:8183/Mfr's Std.	P	V	V	√	

Legend:
Records identified with "√"shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main Vendor
N= BHEL/Customer
P= Perform, W= Witness, V= Verification
Note:1.MTC Will comprise the tests in line with IS:8183
2. MTC will Comprise of chemical & mechanical properties.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR: PRESSURE REDUCING VALVE

PACKAGE-FULE OIL SYSTEM

PROJECT-

CHECK LIST NO.:PE-QP-XXX-166-A802

REV.NO. 0

DATE: 31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY M	AGENCY C	AGENCY N	AGENCY D	REMARKS
1	Review of Material TC for body & diaphragm	One/Lot	Appd.Data Sheet/ Relevant Std.	P	V	V	√	
2	Hydro test of body	100%	Appd.Data Sheet	P	W	V	√	
3	End Connection	100%	-do-	P	W	V	√	
4	Check for IBR TC	100%	-do-	P	V	V	√	

Legend:
Records identified with ' √' shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main vendor/Sub vendor
N= BHEL/Customer,
P= Perform, W= Witness, V= Verification
Note: 1.For IBR Valves, no physical inspection is carried out by contractor/customer.Material will be accepted based on review of IBR Test Certificates.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

PEM MAUX

STANDARD QUALITY PLAN FOR

STRUCTURAL STEEL

QUALITY PLAN NO.:	**PE-QP-XXX-166-A803**
PACKAGE-	**FULE OIL SYSTEM**
PROJECT-	
REV.NO.	**0** **DATE:** 31/03/2012
SHEET	**1 OF 1**

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	Structural	a) Chemical Composition	M	Chemical Analysis	Sample	IS:2062/ Spec./Drg.	IS:2062/ Spec./Drg.	Mfr's TC	✓	P	V*	V	
		b) Mechanical test	M	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	✓	P	V*	V	
		c) Dimensional conformity	M	Measurement	100%	-	-	Mfr's TC	✓	P	W**	V	

***** In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at recogonised testing laboratory.

****** In case material is despatched directly from SAIL/IISCO plant to project site, the witnessing required is waived and material will be accepted on challan & MTC of SAIL/IISCO

LEGEND:
RECORDS INDENTIFIED WITH "✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.
M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER/NOMINATED INSPECTION AGENCY
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

PEM MAUX

STANDARD QUALITY PLAN FOR
STEEL PLATE

QUALITY PLAN NO.:PE-QP-XXX-166-A804	
PACKAGE-FULE OIL SYSTEM	
PROJECT-	
REV.NO. 0	DATE: 31/03/2012
SHEET 1 OF 1	

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS CHECKED	CATEGORY	TYP/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	Steel Plate	a) Chemical Composition	MA	Chemical Analysis	Sample	IS:2062/ Spec./Drg.	IS:2062/ Spec./Drg.	Mfr's TC	3		2*,1	
		b) Mechanical test	MA	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	3		2*,1	
		c) Dimensional conformity	MA	Measurement	100%	-	-	Mfr's TC	3	2**	1	

***** In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at testing laboratory.

****** In case material is despatched directly from SAIL/TISCO plant/Stock yard to project site, the witnessing required is waived and material will be accepted on MTC of SAIL/TISCO

LEGEND

CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL 4-CUSTOMER
2 - Vendor
3 - Sub-vendor

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR: :Safety Relief Valve
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A805
REV.NO.0
DATE:31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY				REMARKS
				M	C	CU	D	
1	Review of Material TC for body & stem	One/Lot	Appd.Data Sheet/ Relevant Std.	P	V	V	√	
2	Hydro test of body	100%	Appd.Data Sheet	P	W	V	√	
3	Set pressure	100%	-do-	P	W	V	√	
4	Check for IBR TC	100%	-do-	P	V	V	√	

Legend:
Records identified with ' √ shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main vendor
CU=BHEL/Customer
P= Perform, W= Witness, V= Verification
For IBR Valves, no physical inspection carried out by contractor/customer.Material will be accepted based on review of IBR test certificates.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR : PLUG VALVE
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A806
REV.NO.-0
DATE: 31/03/2012

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT/ ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
					D	M	C	CU	
A.	RAW MATERIAL								
	Valve Body & Plug:								
1	Chemical Composition	1/Heat	Appd. Data Sheet/	Material TC	√	P	V	V	
2	Tensile, Elongation	1/Heat	Relevant Std.						
B.	FINAL INSPECTION								
1	Visual Exam.	100%	Appd.Drg./Data Sheet	Inspn. Report	√	P	W	W	
2	Dimensional Check	100%	Appd.Drg./Relevant Std.	-do-	√	P	W	W	
3	Hydro Test of Body & Seat	-do-	Appd. Data Sheet/No leakage	-do-	√	P	W	W	
4	Pneumatic Test for Seat	-do-	Appd. Data Sheet/No leakage	-do-	√	P	W	W	
5	Performance/Operation test	-do-	Smooth operation/ Full travel	-do-	√	P	W	W	
6	Painting	100%	Tech. spec/Mfr's std.	-do-	√	P	V	V	

Note:
1. All material of construction shall be as per approved drawing/Data sheet
2. For Actuator operating valves - actuator test certificates shall be furnished to BHEL for review.

Legend
M= MANUFACTURER
C = MAIN VENDOR
CU= BHEL/Customer
P= PERFORM; W= WITNESS; V= VERIFICATION
√ Marked document to be furnished along with QA Doc. Pkg.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR

SUMP PUMP

QUALITY PLAN NO.:PE-QP-XXX-166-A807

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**

SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY CU	AGENCY D	REMARKS
1	2	3	4	5	6	7	8	9	10				11
1.0	**RAW MATERIAL**												
1.1	CASING/ROTOR(IMPELLER) HOUSING	i) SURFACE DEFECTS	MAJOR	VISUAL	100%	APPD.DATA SHEET/ DRG./	APPD.DATA SHEET/ DRG./	IR & TC	P	V	-		
		ii) DIMENSIONAL CONFORMITY		MEASUREMENT	100%	MFR's DRG./IS:210 Gr.	MFR's DRG./IS:210 Gr.						
		iii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	FG 200/RELEVANT STD.	FG 200/RELEVANT STD.						
		iv) HARDNESS TEST		MEASUREMENT	100%								
1.2	IMPELLER	i) SURFACE DEFECTS	MAJOR	VISUAL	100%	APPD.DATA SHEET/DRG.	APPD.DATA SHEET/DRG.	IR & TC	P	V	-		
		ii) DIMENSIONAL CONFORMITY		MEASUREMENT	100%	MFR's DRG./	MFR's DRG./						
		ii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	RELEVANT STD.	RELEVANT STD.						
		iv) HARDNESS		MEASUREMENT	100%								
		v) DYPENETRATION TEST (AFTER MACHINING)		DYEPENETRATION TEST	100%	ASTM E165	NO LINEAR INDICATION	IR & TC	P	V	V	✓	
1.3	SHAFT	i) DIMENSIONAL CONFORMITY	MAJOR	MEASUREMENT	100%	MFR's DRG./	MFR's DRG./	IR & TC	P	V	-		
		ii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	APPD. DATA SHEET/ MFR's CATALOGUE	MFR's CATALOGUE/ RELEVANT STD.						
		iii) UT DIA > 50MM **		UT	100%	ASTM A388	ASTM A388		P	V	V	✓	(**) WHEN BACKWALL ECHO IS SET TO 100% OF FSH IN SOUND AREA: 1) DEFECT ECHO NOT TO EXCEED 20% OF FSH 2) BACK WALL ECHO HEIGHT TO BE 80% MIN. OF FSH. FREQ. 2 MH_Z MIN.
1.4	SHAFT SLEEVE	i) CHEMICAL ANALYSIS	MAJOR	CHEMICAL	1/HEAT	MFR's STD./MFR's	RELEVANT STANDARD/	IR & TC	P	V	-		
		ii) HARDNESS		MEASUREMENT	100%	CATALOGUE	IS						
1.5	WEARING RINGS	i) MECHANICAL & CHEMICAL TEST	MAJOR	PHYSICAL PROPERTIES/ CHEM. PROPERTIES	1/HEAT	MFR's STD./MFR's CATALOGUE	RELEVANT STANDARD/ IS	IR & TC	P	V	-		
		ii) HARDNESS		MEASUREMENT	100%								

LEGEND:

RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER

C - MAIN VENDOR

CU - BHEL/CUSTOMER

INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION

IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
SUMP PUMP

QUALITY PLAN NO.:PE-QP-XXX-166-A807
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0
SHEET 2 OF 2
DATE: 31/03/2012

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY CU	AGENCY D	REMARKS
1	2	3	4	5	6	7	8	9	10				11
2.0	**INTERNAL TEST**												
2.1	CASING	SOUNDNESS OF CASTING	MAJOR	HYDROSTATIC TEST	100%	HYDROSTATIC TEST AT 200% OF PUMP RATED HEAD OR 150% SHUT OFF HEAD WHICHEVER IS HIGHER FOR 30 MTS.	NO LEAKAGE	IR & TC	P	V	V	✓	
2.2	SHAFT	DP ON SHAFT	MAJOR	DPT	100%	ASME E165	NO LINEAR DEFECTS	IR & TC	P	V	V	✓	
2.3	IMPELLER	RESIDUAL UNBALANCE	MAJOR	DYNAMIC/STATIC BALANCING	100%	ISO 1940 GR.6.3	ISO 1940 GR.6.3	IR & TC	P	V	V	✓	
3.0	**FINAL INSPECTION**												
3.1	OVERALL DIMENSION	DIMENSIONAL	MAJOR	MEASUREMENT	100%	APPD. DRAWING/ MFR's DRAWING	APPD. DRAWING/ MFR's DRAWING	IR & TC	P	W	W	✓	
3.2	PERFORMANCE TEST WITH LAB MOTOR	i) Q V/s HEAD ii) Q V/s POWER iii) Q V/s EFFICIENCY iv) NOISE LEVEL & VIBRATION	CRITICAL	MEASUREMENT	100%	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS 85 dBA MAX. AT 1Mtr, & 75 MICRON MAX.	IR & TC	P	W	W	✓	
3.3	STRIP TEST	STRIP TEST	CRITICAL	VISUAL (WEAR & TEAR)		**	NO UNDUE WEAR	IR & TC	P	W	W	✓	
3.4	REVIEW OF DOCUMENTATIONS					APPD. QAP	APPD. QAP		V	V	V	✓	
3.5	PAINTING	VISUAL	MINOR	VISUAL	100%	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	IR	P	V	-		** STRIP DOWN TEST ON 100% BASIS SHALL BE DONE INCASE ABNORMAL PERFORMANCE OTHERWISE SAME SHALL BE RESTRICTED TO BEARING INSPECTION ONLY
	NOTE: ALL MATERIAL OF CONSTRUCTION SHALL BE AS PER APPROVED DATA SHEET/DRAWING												

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION
IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 3

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9				10	
1.0	**MATERIALS:**												
1.1	BODY & END PIECE	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	MATRL. TC/ MFR'S TC	✓	P	V	V	
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREAT-MENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V	
		HEAT TREATMENT	- DO -	REVIEW OF HT CHART	100%	- DO -	- DO -	- DO -/HT CHART	✓	P	V	V	
		IDENTIFICATION & CORRELATION	MAJOR	VISUAL	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-	
		SURFACE DEFECTS	- DO -	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-	
		DIMENSIONAL	- DO -	MEASU-REMENT	100%	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	LOG BOOK		P	V	-	

LEGEND:
RECORDS, IDENTIFIED WITH ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M: MANUFACTURER .
C:MAIN VENDOR, CU: BHEL/CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 3

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9	10				11
1.2	BALL, SPINDLE, GLAND, LEVER FASTENERS	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	TEST CERT.	✓	P	V	V	
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREAT-MENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V	
		HEAT TREATMENT (as applicable)	- DO -	REVIEW OF HT CHART	100|%	- DO -	- DO -	- DO -/ HT CHART	✓	P	V	V	
		SURFACE DEFECTS	MAJOR	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-	
		DIMENSIONS	- DO -	MEASU-REMENT	100%	APPD. DRG./ RELEVANT STD.	- DO -	LOG BOOK		P	V	-	
1.3	BODY SEAL, STEM SEAL, GLAND PACKING	DIMENSIONS	- DO -	- DO -	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-	
		TEMPERATURE RESISTANCE	- DO -	TEMP. CHECK	100%	PTFE /RELE-VANT STD.	RELEVANT STD.	TEST CER-TIFICATE	✓	P	V	V	
2.0	**IN-PROCESS INSPECTION:**												
2.1	MACHINING OF BODY END-PIECE GLAND BALL, SPINDLE	DIMENSIONS	-DO-	MEASU-REMENT	100%	MFG. DRG.	MFG. DRG.	LOG BOOK		P	V	-	
		SURFACE FINISH	- DO -	VISUAL	100%	- DO -	MFG. DRG./MFG. STD.	- DO -		P	V	-	
2.2	BALL, SPINDLE	HARDNESS	-DO -	HARDN-ESS TEST	100%	APPD. DRG./ DATA SHEET/ TECH.SPEC.	APPD. DRG./ DATA SHEET/ TECH.SPEC./MFG. STD.	TEST CERT.	✓	P	V	V	
		SURFACE DEFECTS	CRITICAL	DPT	100%	ASTM-E-165	NO LINEAR INDICATION	INTERNAL RECORD	✓	P	V	-	

LEGEND:
RECORDS, IDENTIFIED WITH ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M: MANUFACTURER .
C: MAIN VENDOR, CU: BHEL/CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**

SL .NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
2.3	BALL & SEAT	BLUE MATCH	CRITICAL	BLUE MATCHING	100%	THE SURFACE WILL BE SMOOTH & WILL HAVE UNIFORM METAL TO METAL CONT-ACT	SAME AS COL.7	LOG BOOK	✓	P	V	V	
3.0	**ASSEMBLY**	DIMENSIONS	MAJOR	MEASUR-EMENT	*AS PER NOTE-1 BELOW	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	INTERNAL RECORD	✓	P	W	W	
		OPENING & CLOSING	- DO -	OPERA-TION	- DO -	SMOOTH OPERA-TION OF VALVE	- DO -	- DO -	✓	P	W	W	
4.0	**TESTING:**												
4.1	SHELL	LEAKAGE	CRITICAL	HYDRO-STATIC	*AS PER NOTE-1 BELOW	APPD. DRG./ DATA SHEET	NO LEAKAGE	TEST CER-TIFCATE	✓	P	W	W	
4.2	SEAT	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	✓	P	W	W	
4.3	SEAT	- DO -	- DO -	AIR	- DO -	- DO -	- DO -	- DO -	✓	P	W	W	
4.4	FIRE SAFE TEST REPORT WITNESSED BY LLOYD/BV SHALL BE FURNISHED FOR REVIEW								✓	P	V	V	
4.5	REVIEW OF QA DOCUMENTATION AS PER APPD. QP								✓	P	V	V	
5.0	**PAINTING :**	QUALITY & THICK-NESS OF PAINT	MAJOR	VISUAL & MEASU-REMENT	100%	TECH. SPEC./ DATA SHEET/ MFG. STD.	SAME AS COL.7	INTERNAL RECORD		P	V	-	
6.0	**PACKING:**		MAJOR	VISUAL	100%			INTERNAL RECORD		P	-	-	

NOTE-1:
100% BY MANUFACTURER
10% BY TECHNO
For Actuator operating valves - Actuator test certificate shall be furnished to BHEL for review.
For Fire safe valves - valves are to be accepted based on fire test certificates

LEGEND:
RECORDS, IDENTIFIED WITH ' ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M: MANUFACTURER .
C: MAIN VENDOR, CU: BHEL/CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CS PIPE -ERW

QUALITY PLAN NO.:PE-QP-XXX-166-A809
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	ERW PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1
		b) Dimensional conformity	M	Measurement	At random	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	

Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on10% of total quantity will be witnessed by BHEL.

LEGEND:
RECORDS INDENTIFIED WITH "✓" " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800 & 1 NO. 50 NB GLOBE VALVE #600) (65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1	**Raw Material:**												
	Body, bonet, gld.,Flange, Disc, / wedge	Chem. & mech. Test	CR	Chem.& mech.Test	Per Heat	Appd.Drg/.	Relevant Standard	MTC	✓	P	V	V	Body will carry the heat
		Dimensions	MR	Measurement	100%	Mfg. Drg./ Data Sheet	Mfg. Drg./ Data Sheet	IR	✓	P	V	V	mark for co-relation with
		Surface quality	MR	Visual	100%	Mfg. Drg./ Data Sheet	Defect Free	IR	✓	P	V	V	CMT
1.1	Stem,body seat ring,gland.	Chem. & mech. Test	CR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	MTC	✓	P	V	V	
1.2	Fasteners	Chem. & mech. Test	MR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
1.3	Gasket & gland packing	Compliance to PO	MR	Measurement	100%	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
2.0	**In Process Inspection**												
2.1	Machining of valves components	Surface quality	MR	Visual	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
		Dimension	MR	Measurement	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
2.2	Spindle	Surface finish	MR	Measurement	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
2.3	Wedge / disc , seatring, stem & back seat	Lapping	MR	Blue Matching	100%	100% metal to metal contact	100% metal to metal contact	IR	✓	P	V	V	

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M MANUFACTURER/SUB-CONTRACTOR
C CONTRACTOR/NOMINATED INSPECTION AGENCY,
N CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
V VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"
IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800
(65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	N	REMARKS
1	2	3	4	5	6	7	8	9			10		11
3.0	**Testing & Final Inspection**												
3.1	Performance	Operation	CR	Manual	100%	Appd. Drg./Data Sheet	Should be smooth	IR	✓	P	W	W*	
3.2	Shell &Sheet / backseat	Pr. Testing	CR	Hyd. Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	
3.3	Seat	Pr. Testing	CR	Pneumatic Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	Not Applicable for Check Valve
3.4	Valve Assembly	1. Chk. For completeness/ Visual Inspection	MR	Visual	100%	Appd. Drg. / Tech. Spec./ Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	
		2. Dimention	MR	Measurement	10%	Appd. Drg./Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	*RANDOM 10% BY CUSTOMER
		3. Wear Travel / valve lift	MR	Manual	100%	Appd. Drg.	Appd. Drg.	IR	✓	P	W	W*	
4.0	**Painting & Packaging**												
		1. Painting & Packaging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	IR		P	V		
		2. Tagging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	PS / RS		P	V		

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M MANUFACTURER/SUB-CONTRACTOR
C CONTRACTOR/NOMINATED INSPECTION AGENCY,
N CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
V VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"
IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR

OIL STRAINER

QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
1.0	**Raw Material**												
1.1	Body, flange, dished end	Physical & Chemical Properties	MA	Physical & Chemical Test	1/Sample	Appd. Drg.	Appd. Drg./ Mfg.Std.	Mtrl.TC	√	P	V	V	
1.2	Screen	1. Chem. composition	MA	Chem. Test	1/Sheet	- do -	- do -	- do -	√	P	V	V	
		2. Dimension, Mesh Size	MA	Meas.	100%	- do -	- do -	log book		P	V	V	
2.0	**In Process**												
2.1	Welding Procedure Specification	Parameter	MA	Verification	100%	ASME-IX	ASME-IX	QW-482	√	P	V	V	BHEL approved WPS & PQR Shall be furnished for review.
2.2	Procedure Qualification Record & Welder Qualification	Weld Soundness/ Qualification	MA	Qualification test RT	100%	ASME-IX	ASME-IX	QW-483/484	√	P	V	V	
3.0	Weld fit up	Dimension alignment orientation	MA	Meas./ Visual	100%	Appd. WPS	Appd. WPS	log book		P	V	V	
4.0	Weldments - Final Run (all welds)	Surface Defect	MA	Penetration Test	10%	ASTME-165	No defects	- do -	√	P	V	V	
4.1	Root run (butt welds & back gauged welds)	-do-	MA	-do-	100%	-do-	-do-	-do-	√	P	V	V	

LEGEND:
RECORDS INDENTIFIED WITH "√ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND"
V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR

OIL STRAINER

QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
5.0	Assembly of Internal Fittings Basket placement	Orientation Location of Tapping Points & fitting of Internals	MA	Visual & Meas.	100%	Appd. Drg.	Appd. Drg./ Mfg.Std.	log book		P	V	V	
6.0	Final Assembly												
6.1	Final Inspection	Completeness Cleanliness Dimension	MA	Visual & Meas.	100%	- do -	Appd. Drg./ Data Sheet	Inspection Report		P	W	W	
		Leak tightness	CR	Hyd. Test at 1.5 times of design pr. for 30 min.	100%	- do -	No leakage	Test Record	√	P	W	W	
7.0	Review of QA Documents as per QP												

LEGEND:
RECORDS INDENTIFIED WITH "√ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND"
V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)

QUALITY PLAN NO.:PE-QP-XXX-166-A812
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO. 1	COMPONENT & OPERATIONS 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY D	AGENCY M	AGENCY C 10	AGENCY CU	REMARKS 11
1.0	**Raw Material & Bought Out Items**												
1.1	Casing, stuffing box & end cover	i) Chemical test	MA	Chemical Analysis	Sample/ heat	Appd. Data Sheet/ Appd. Drg./ IS:210 FG260	Same as Cl.7	Material TC	√	P	V	V	
		ii) Physical test	MA	Physical Properties	Sample/ heat	- do -	Same as Cl.7	Material TC	√	P	V	V	
		iii) Hardness	MA	Meas.	At random	As per Appd. Data Sheet	- do -	Material TC	√	P	V	V	
1.2	Shaft, Rotor,Step-up gear,Timing gear	i) Chemical test	MA	Chemical Analysis	Sample/ heat	As per Appd. Data Sheet/ Drg.	Same as Cl.7	Material TC	√	P	V	V	
		ii) Physical test	MA	Physical Properties	- do -	- do -	Same as Cl.7	Material TC	√	P	V	V	
		iii) Heat treatment	MA	Heat treatment	100%	- do -	- do -	HT Chart	√	P	V	V	
		iv) Hardness	MA	Meas.	- do -	- do -	- do -	- do -	√	P	V	V	
1.3	Bearing	Make, size & bearing No.	MA	Visual	100%	Mfg. Drawing/ Mfg.Catalogue	- do -	Log Book		P	-	-	
2.0	**In Process Control**												
2.1	Machining of all Components	i) Dimension	MA	Meas.	100%	- do -	- do -	- do -		P	V	V	
		ii) Surface finish	MA	Visual	100%	- do -	- do -	- do -		P	-	-	
2.2	Casing	Pressure test	MA	Hyd.Test with water	100%	1.5 x max. discharge pr. for 15 minutes.	No leakage/Seepage	Test Report	√	P	V	V	
2.3	Shaft, Rotor/Screw, Step-up gear, timing gear	1. Internal Defects	CR	UT(after skin - machining)	100%	ASTM A388	Refer Note.1 (page2)	Test Report	√	P	V	V	
		2. Surface Defects	CR	DPT(after - final machining)	100%	ASTM E:165	No linear indication >1.6mm	Test Report	√	P	V	V	
		3. Case Hardness of timinng gear	CR	Hardness	100%	EN-36 to BS970/ As per data sheet	After case carburising, hardened & tempered to have tooth hardness of 56 to 59 HRC	H T report	√	P	V	V	NA
2.4	Balancing of Rotor Assly.	Static & Dynamic	CR	Balancing	100%	VDI 2060 Cl. 6.3/ ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	Test Report	√	P	V	V	only in case of Twin Screw Pump

LEGEND:
RECORDS INDENTIFIED WITH "√" " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
"CU" BHEL/CUSTOMER,.
"P" PERFORM "W" WITNESS AND
"V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)

QUALITY PLAN NO.:PE-QP-XXX-166-A812
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	CU	
1	2	3	4	5	6	7	8	9	D		10		11
3.0	**Assembly Control Final Inspection & Testing:**												
3.1	Pump Assembly	i) Completeness, correctness, overall dimension	MA	Visual & Meas.	100%	Appd. Drg.	Same as Cl.7	Log Book	√	P	W	W	
3.2	Performance Test - with test bed motor	1.Performance for capacity, head,power consp., speed, efficiency.	CR	Performance Test	100%	VDMA/ HIS/Appd. Data sheet	Appd. Data sheet/curves/ VDMA/HIS	Test Report	√	P	W	W	
		2. NPSHR for twin Screw pump	CR	- do -	10%	-do-	Appd. Data sheet/curves Appd. Document	- do -	√	P	W	W	
		3. Vibration/Noise	CR	- do -	100%	Appd. Data Sheet/ Value given in Cl.8	75 micron at bearings 85 dbA measured at a distance of 1 mtr.	- do -	√	P	W	W	Noise & vibration value measured at shop is for reference only.
		4. Relief valve set pr.	CR	- do -	100%	Appd. Data Sheet	Same as Cl.7	- do -	√	P	W	W	
3.3	Review of QA Documentation as per approved QP			-	-	-	-	-		V	V	V	
3.4	Painting	Surface Preparation & shade of painting	MA	Visual	100%	As per Mfg. Std.	Same as Cl.7	-		P	V	-	

Note: 1. Defect giving echo height more than 20% on total CRT Screen height shall be treated as unacceptable..
Defect causing reduction in backwall echo less than 80% of Screen height shall be treated as unacceptable. Frequency 2 MHz min.
2. In case of mismatch in material in QP with Data Sheet, the material indicated in approved data sheet will be final.

LEGEND:
RECORDS INDENTIFIED WITH "√ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER
"C" MAIN VENDOR
"CU" BHEL/CUSTOMER,.
"P" PERFORM "W" WITNESS AND
"V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CS PIPE -SEAMLESS

QUALITY PLAN NO.:PE-QP-XXX-166-A813
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	SEAMLESS PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	ASTM A106 Gr.B/ Appd. Data sheet	ASTM A106 Gr.B/ Appd. Data sheet/ Relevant Std.	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1
		b) Dimensional conformity	M	Measurement	100%	-do-	-do-	MTC/ Mfr's TC/IR	✓	P	V	V	
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	

Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on10% of total quantity will be witnessed by BHEL

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
IB TYPE & TD TYPE STEAM TRAP 25NB & 15NB

QUALITY PLAN NO.:PE-QP-XXX-166-A814
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9			10		11
1	**Raw Material**												
	Body, Filter cap, Disc, Cover & Filter screen	I) Chemical Composition	Major	Chemical Analysis	Sample Check	As per Appd. Drg./ Data Sheet	As per Appd. Drg./ Data Sheet	MTC	✓	P	V	V	
		ii) Mechanical Test	Major	Physical properties	- do -	- do -	- do -	- do -		P	V	V	
2	**Final Inspection**												
		i) Visual	Major	Visual Inspn.	100%	As per Appd. Drg.	As per Appd. Drg.	Inspn. Report		P	W	V	
		ii) Dimension	Major	Meas.	100%	- do -	- do -	- do -		P	W	V	
		iii) Hyd. Test	Major	Leak Test	100%	As per Appd. Drg./ Data sheet	As per Appd. Drg./ Data sheet	Test Report	✓	P	W	V	
3	Review of QA Documents as per approved QP									V	V	V	IBR certificate as applicable shall be furnished as part of QA documentation.

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER.
INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION
IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
SUCTION HEATER (HEAT EXCHANGER)

QUALITY PLAN NO.:PE-QP-XXX-166-A815
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	N	
1	2	3	4	5	6	7	8	9			10		11
1.	Materials												
	a) Shell, plates for tube sheet, & Dished end	i) Chemical Composition	Major	Chemical Analysis	Sample	Appd.Drg./ASME SEC-II	Same as Cl.7	Material Test Cert.	√	P	V	V	
		ii) Mechanical Test	Major	Physical Properties	- do -	- do -	- do -	- do -	√	P	V	V	
	b) Tubes	i) Chemical Composition	Major	Chemical Analysis	- do -	- do -	- do -	- do -	√	P	V	V	
		ii) Mechanical Test	Major	Physical Properties	- do -	- do -	- do -	- do -	√	P	V	V	
2.	In Process Inspection												
A.	U-Tube	i) Thinning Test on tubes	Major	By Destruction test	Sample	TEMA' C/Appd. Drg.	17% thining	Inspn. Report	√	P	V	V	
		ii) Mock-up Test on tube to tube sheet joint	Major	- do -	100%	- do -	- do -	- do -	√	P	V	V	
		iii) Dimensional Check	Major	By Meas.	100%	Appd. Drg.	- do -	- do -		P	V	-	
		iv) Hydraulic Test (for tube bundle)	Major	Hydraulic	100%	Appd. Drg.	No Leakage	- do -	√	P	V	V	
B.	Shell	a) Welding Procedure	Major	WPS	100%	ASME-Sec.IX	Same as Cl.7	QW-482	√	P	V	V	WPS to be approved by BHEL/ NTPC. Qualified welders only
		b) Welder Procedure Qualification Test	Major	PQR	100%	- do -	- do -	QW-483	√	P	V	V	to be employed.

LEGEND:
RECORDS INDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR

SUCTION HEATER (HEAT EXCHANGER)

QUALITY PLAN NO.:PE-QP-XXX-166-A815

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**

SHEET 1 OF 1

SL. NO. 1	COMPONENT & OPERATIONS 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY D	AGENCY M	AGENCY C	AGENCY N	REMARKS 11
		c) Dimensional Check	Major	Meas.	100%	Appd. Drg.	Same as Cl.7	Inspn. Report		P	V	-	
C.	Tube Sheets	a) Dimensional Check	Major	Meas.	100%	- do -	- do -	- do -		P	V	-	
		b) Assembly Check	Major	Visual	100%	- do -	- do -	- do -		P	V	-	
3.	Final Inspection												
	Finished Product after completion	i) Welding	Major	Visual	100%	Appd. WPS	- do -	- do -		P	V	V	
		ii) NDT for Shell fabrication	Major	DP test	100%	ASME SEC-V	- do -	- do -		P	V	V	
		iii) NDT for Dished end to Shell joint	Major	Spot Radiography	10%	- do -	- do -	Radiography Report	✓	P	V	V	
		iv) NDT for Shell to Tube sheet joint	Major	DP test	100%	- do -	- do -	Inspn. Report		P	V	V	
		v) NDT for Dish fabrication	Major	DP test on Knuckle	100%	- do -	- do -	- do -		P	V	V	
		vi) Dimensional Check	Major	Meas.	100%	Appd. Drg.	- do -	- do -	✓	P	W	W	} CHP
		vii) Hydraulic Test for Shell side and tube side	Critical	Hydrostatic	100%	Appd. Drg./ 1.5 x Design Pr.	No Leakage	- do -	✓	P	W	W	} CHP
		viii) Review of QA Document as per approved QP	-	-	-	-	-	-		-	-	-	
		ix) Painting	Major	Visual	100%	Mfg. Std.	Same as Cl.7	-		P	-	-	

LEGEND:
RECORDS INDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR OIL HOSE

CHECK LIST NO.:PE-QP-XXX-166-A816
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0
SHEET 1 OF 1
REV.NO. 0 **DATE: 31/03/2012**

SL. NO. 1	COMPONENT & (2	CHARACTERISTICS 3	TYPE OF CHECK 4	REFERENCE DOCUMENT 5	ACCEPTANCE NORMS 6	FORMAT OF RECORD 7	AGENCY M	AGENCY C	AGENCY N	REMARKS 9
								8		
1	Material for									
1.1	Synthetic Rubber	Polymer Confirmation	Chemical Analysis	Appd.data sheet/ Relavent Code	Same as Cl.7	Lab Test Certificate	P	V	V	
1.2	Canvas	Mechanical Test	Tensile	-do-	-do-	- do -	P	V	V	
1.3	Bonding Agents	Bonding Strength	Properties	-do-	-do-	- do -	P	V	V	
1.4	End Fittings	Chem. & Mech. Test	Chem.& Mech properties	-do-	-do-	- do -	P	V	V	
2	In Process Inspection									
2.1	Compound									
	Oil Resistance	i) Oil Resistance test	Oil Resistance check	-do-	-do-	Lab Test Report	P	V	V	
		ii) Heat Resistance	Heat Resistance check	-do-	-do-	Lab Test	P	V	V	
2.2	Sheeting	i) Visual Inspection	Visual	Mfg. Drg.	Mfg. Drg.	Inspn. Report	P	-	-	
		ii) Dimension	Meas.	- do -	- do -	- do -	P	-	-	
2.3	Hose Making	i) Visual Inspection	Visual	- do -	- do -	- do -	P	-	-	
		ii) Dimensional	Meas.	- do -	- do -	- do -	P	-	-	
2.4	Wrapping	Tightening	Visual	- do -	- do -	- do -	P	-	-	
2.5	Flange	Dimension	Meas.	- do -	- do -	- do -	P	-	-	

LEGEND:

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR
OIL HOSE

CHECK LIST NO.:PE-QP-XXX-166-A816
PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. **0**
SHEET **1 OF 1**
REV.NO. **0** **DATE: 31/03/2012**

SL. NO.	COMPONENT & C	CHARACTERISTICS	TYPE OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
							M	C	N	
1	2	3	4	5	6	7	8			9
2.6	Vulcanising	Complete Assembly	Hardness	Mfg.Std./Appd.Drg Appd.Data Sheet	Same as Cl.7	Inspn. Report	P	V	V	
3	Final Inspection									
	Finished Product Check for completene	i) Confirmatory Test	Conformity	Appd.data sheet/ Relavent Code	- do -	T.C.	P	V	V	
		ii) Dimension (includ- ing end connection)	Measurement	Appd. Drg.	- do -	Inspn. Report	P	W	W	
		iii) Pressure Test	Hydraulic Test	Appd.data sheet/ Relavent Code	No leakage	- do -	P	W	W	
		iv) Vacuum Test	Vacuum	- do -	Same as Cl.7	- do -	P	W	W	
		v) Elongation	Measurement	- do -	- do -	- do -	P	V	V	
		vi) Electric Continuity	Elec. Cont.	- do -	- do -	- do -	P	V	V	

LEGEND:

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)