



**Tender Notice No.
HY/ES/OPGPGPL/MECH/12**

For

**Mechanical jobs of Erection, Testing, Pre-commissioning and
commissioning of 1X80MW STG at OPGPGPL-Gummidipoondi
Chennai**

**Tender Submission on or before 8th June, 2012 at 1100Hrs
Drop Box at Vendor Complex in BHEL Admin Block**

Tender opening Date 8th June, 2012 at 1430Hrs

**Addl General Manager
External Services Department
02 Annexe, 02nd Floor,**

**Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad – 502 032
Phone: 040-2318 5058, 2318 3409**

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SPEC NO.201:PROJECT INFORMATION

One STG set of 1x80MW STG with auxiliaries and piping etc. are to be erected, tested and commissioned at OPGGPL, Gummidipoondi

PROJECT DATA

- 1. Project Authority : M/s OPG Power Generation Pvt Ltd.**
- 2. Name of the Project : M/s OPG Power Generation Pvt Ltd.**
- 3. Location of Site : Gummidipoondi, Tamilnadu**
- 4. Nearest Railway Station : Chennai**
- 5. Nearest Air Port : Chennai**

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SPEC NO. 202: SCOPE OF WORK

1. It is not the intention in this specification to specify each and every activity in the scope of work. However broadly they are brought out in this section and specification nos. 101, 102 & 103 of this Tender Schedule. Bidder may kindly note the same. For the completeness of the job, bidder to note that all activities to complete the erection, testing and commissioning shall be deemed to have been included. Any minor modifications including strengthening by additional welding etc., if required on the equipment to be erected shall be considered as part of the erection and shall not call for any extra payment. Any rectification work on parting planes, machined surfaces shall also be deemed to have been included in the scope of work.

2. The bidder shall quote "FIRM" Prices only.

The following terms of payment will be operated

- a. **80 % payment against running bills.**
- b. **5% on submission of Protocols.**
- c. **10 % up on final commissioning and material reconciliation.**
- d. **Balance 5% on completion of guarantee period of one year from commissioning or against bank guarantee.**
- e. **Security deposit will be deducted as per rules and paid on completion of guarantee period.**
- f. **Service Taxes will be paid extra as per the prevailing government rates on submission of necessary documents.**

3. For equipment erection the bidder shall quote a tonnage rate. The payment shall be on actual net weight of equipment erected. The terms of payment shall be strictly governed by specification No. 204. Any deviation to the terms of payment will be evaluated in terms of loading on the prices. The tonnage indicated is only approximate and may vary. Bidder shall agree to keep the rates valid for any variation of quantity.

4. Erection, testing, pre-commissioning and commissioning of the equipment using contractor's own tools and tackles, consumables, including electrodes, skilled and unskilled manpower etc., as per the detailed description and nature of work as enumerated in tender schedule and this specification, includes all handling and transportation of materials from storage yard and site to pre-assembly area and place of erection and other incidental works required prior to and during pre-fabrication, pre-assembly, erection, testing, pre-commissioning and commissioning of entire system. The scope shall include necessary chipping and dressing of foundations up to a minimum of 50 mm till the required accuracy are obtained for blue matching with the packer plates.

DETAILS OF THE EQUIPMENTS TO BE ERECTED ARE INDICATED IN THE PRICE SCHEDULE SL.No. 1.01.00 SPEC NO 204

Unit rates quoted for metric ton includes the following activities of the works:

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- 1. ERECTION**
- 2. TESTING**
- 3. PRE-COMMISSIONING**
- 4. HYDRAULIC TESTING OF EQUIPMENT AND PIPING**
- 5. PAINTING (SUPPLY AND APPLICATION)**

5. During the erection, testing, pre-commissioning and commissioning works, some repairs, rectification and modifications etc. are likely to occur. Bidder shall note that they are part of scope of job. The bidder while quoting the rates shall take the above in consideration and no extra payment will be entertained on this account.

NOTE:

Examples for repairs, rectification, modifications etc.

1. Mismatching of exhaust hood flanges,
2. Machine base plate hole enlarging for adjustments,
3. Supports welding to equipment and rectification as per site condition,
4. Matching of filter section,
5. Additional chipping of foundation,
6. Changing of parts when they fail during the tests etc.,
7. Re-reaming of Coupling bolts holes etc.
8. Any parting plane blue matching etc.,
9. Providing of small opening on oil tanks & mounting of oil pumps. These points are only few examples, similar types of other works are also likely to come which are incidental to the nature of erection work.

6. For any extra equipment & structural the approved unit rates of erection only will be applicable, and this will not be treated as extra works for payment on man hour rates basis.

7. For piping, bidder shall quote a rate per joint / running length separately for:

- a. Fit up and welding,
- b. Radiography

As given in the specification No. 204 (Price Tabulation). Pipe size, welding type details and no. Of joints (approximate) are given for pipe sizes above 48.3 mm Nb. Bidder shall agree to keep the rates valid for any quantity variation.

8. For piping erection, the contractor shall quote rate per meter length. The piping erection includes all types of piping hangers, supports, fittings (tapings points for instruments, vents and drains as applicable) and Hydraulic test of piping, painting etc. For pipe sizes

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48.3 mm and less erection includes fit up and welding, radiography, Stress Relieving, etc also where ever required.(Size dia 48.3 mm and less pipes are site routed). Apart from this, the bidder is required to include the jobs of degreasing, mechanical cleaning, steam blowing, oil flushing, pickling and washing, Alkali flushing, cardboard blasting and sand blasting etc. including consumables in the Unit rates quoted and no separate payment will be considered for these jobs. All pipe sizes and corresponding lengths are indicated in tabular column of specification No. 204. Bidder should agree to keep the rates valid for any quantity variation.

The Bidder shall arrange to obtain all approval with reference to IBR and deal with IBR directorate / Local IBR authority for approval of drawings, qualification of welders field inspection of materials, joints, radiography and hydraulic test etc. The price offered by the bidder shall include the expenditure towards the above including incidentals of any kind. However the statutory fees shall be paid by BHEL.

NOTE: The rates shall be quoted only in the format enclosed. Deviation in the form of addition / deletion / omission in the format is not acceptable and may result in rejection of bid.

9. For thermal insulation (application only) bidder shall quote a unit rate per Sq. meter for equipment and per meter length for piping including pipe fittings like elbows, tees, reducers, flanges and Valves etc. The thermal insulation job shall be carried out as per the specification No. 51765, 56276 and 4-38101-01000 and includes aluminum cladding, fixing arrangements of thermal insulation etc including all consumables. Bidder shall agree for any variation of quantity without change of rate. Bidder to note that material shall be supplied by BHEL.

10. All piping will be supplied to site in commercial lengths. Fabrication and edge preparation of all piping including welding of stubs on piping for instrumentation tap off points, and providing drains, vents and any other connection points shall be included in the contractor's scope. The unit rates indicated in table 1.04.00 should include the complete scope.

11. Any changes, modifications, involving rerouting of piping, cutting, repairing and re-welding, the payment shall be on the joints basis only as per the approved rates and not at man-hour rates. No separate payments are envisaged for jobs involving cutting of already completed joints.

12. Bidder has to carry out mechanical cleaning, pickling, acid cleaning, alkali flushing, cardboard blasting, etc. as per the guidelines given in the documents enclosed. No separate payments are envisaged for these jobs. The Bidder shall include for these jobs in the unit rates quoted.

Bidder shall also carry out steam blowing in stages (approx. 4 to 5) as per the site requirements. Steam blowing is to be done by installing spool pieces, aluminum target plates elbows, necessary temporary supports, etc temporarily. After completion of steam blowing nozzles, orifices valves and other specialties, etc have to be (restoration work) installed by cutting / welding of pipes. The permanent supports shall be installed

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later. The contractor to note that the restoration of pipelines, valves & specialties, etc (upon completion of steam blowing activity) shall form a part of the scope of work. No separate payments for these activities are earmarked. Bidder to note this aspect & accordingly bid for these B.O.Q, given in the Price Schedule.

13. The Bidder to note that they have to provide commissioning assistance as per the site requirement during commissioning. No separate payments are envisaged and the unit rates quoted for erection and commissioning are deemed to have taken care of this requirement. **Commissioning is deemed to be completed on successful run of the unit for 72 hours continuously.**

14. **PROTOCOL & DOCUMENTATION:**

Bidder shall prepare all the necessary documents/ protocol in connection to equipment erection, testing, piping erection, radiography film, joints inspection reports, as built drawings, reports and other relevant document in the format approved by BHEL and/or Client/ Consultant. **For preparation of documents, the bidder shall supply one lap top computer with latest version software (i.e. minimum core 2 Duo, 2.26 G Hz, 3 GB Ram, 250 GB HDD, High Bright screen of 15.4” with DVD Writer) along with a printer to BHEL site office without any extra cost.**

15. **PAINTING:**

The Bidder shall consider total five (5) coats (including the primer) of painting for the items to be erected i.e. equipment, piping and auxiliaries, etc for the purpose of quotation and the work is subject to inspection / approval by BHEL’s client. Pipes are to be grid blasted before painting. Supply and Application of Paints are included in contractor scope. Expenditure towards this job shall be included in the unit rates quoted and no separate payments are envisaged.

16. **POWER POINT:**

Bidder to kindly note that the construction power and water will be provided at single point at site within reasonable distance for the job. The successful bidder shall have to at his own cost provide necessary distribution cabling etc by him. The Bidder has to ensure that the statutory regulations are met with while executing the work.

17. **GROUTING MATERIAL:**

The rate for equipment erection and commissioning shall include the cost of grout cement for the equipment and no separate payments are envisaged in the contract. For information of bidders the requirement of cement will be approximately 6.0 Tons for main equipment. All materials etc shall be arranged by the bidder at his cost. Grouting material specification is included in the annexure.

18. Bidder to Note that:

Turbine and Generator will be supplied loose. They are to be arranged at site. No extra payment is allowed for this.

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19. ACCEPTANCE OF THE TENDER

Acceptance of the tender will be intimated to the successful bidder through a letter of intent / Fax of intent. The bidder shall then be required to execute an agreement annexed at the end (Annexure I & II), within seven (7) days from the date of issue of the letter of Intent. In the event of failure on the part of the contractor to sign the agreement within the specified time, the earnest money deposit shall be forfeited and the acceptance of his tender shall be considered as withdrawn.

20. CONTENTS OF THE CONTRACT DOCUMENTS

The letter of submission of tender, notice inviting tender, scope of inquiry, Instruction to bidder, general conditions of contract, general and technical specifications, tender proposal forms, tender drawings, contract form between the bidder and BHEL, forms of different deeds (as applicable), amendments/ addenda / corrigenda and interpretations/ clarifications as issued by BHEL subsequent to issues of tender documents (if any), bidder's tender No. dated all correspondences, minutes of meetings, agreed variations etc., between the bidder and BHEL till issue of the letter of intent by BHEL, agreed quality assurance programme and time schedule network together with the letter of intent issued by BHEL, all pertaining to this tender, agreed man power deployment together with their technical qualifications etc., shall form the contract.

21. The contract document shall be containing, the scope of inquiry, general and technical specifications and amendments / addenda / corrigenda, interpretation / clarifications issued by BHEL on technical aspects, as well as all correspondences, minutes of meetings etc., between the bidder and BHEL on technical aspects, agreed quality assurance programme, time schedules network, and the rest of documents listed in clause 20 above.

22. The Bidder shall prepare , one (1) original of Contract as described in clauses 19, 20 & 21 above within seven (7) days of signing the contract agreement and shall arrange six (6) true copies of the contract documents free of charge within 4 weeks from the date of signing the contract agreement. After retaining one copy with them for their use, the contractor shall hand over remaining 5 copies to BHEL for their use at site & head quarters including their finance department.

23. List of Documents enclosed:

- | | |
|----------------------------------|------------------------|
| 1. Site Erection notes | : 16 sheets |
| 2. Plant Standard (Welding ends) | :HY 0620599 (6 Sheets) |
| 3. Specification for insulation | :PP-5-1503 (8 Sheets) |
| 4. Standard for Grouting | :TC-9-1900 (3 Sheets) |

SAFETY:

Safety during job execution is of paramount importance to us. Bidder's representatives shall adhere to the safety norms and requirements as mentioned in tender schedule which forms an integral part of our order. Also an annexure covering, engineering standards and practices prevalent in our works, is enclosed for reference. Since the erection work shall be done close to the operating plant, necessary safety /work permits shall be taken from our authorized engineers before commencement of any job. Bidder shall appoint and inform us the name, & qualification of the person, from your team, who shall be responsible for safety during job execution. For safety related issues, he will work in close coordination with Safety Officer authorized by customer.

SAFETY REGULATIONS

Bidder shall ensure trained men attend work in safe apparel and are provided with requisite safety appliances, safe tools/tackles etc. thereby ensuring safe working conditions. The work shall be carried out under bidder's competent supervision only and duly tested tools/tackles/appliances as per statutes in force shall be used and a copy of their test certificates shall be furnished to us on demand by our engineers. Bidder be solely responsible and shall ensure that all safety requirements under relevant statutes in force are complied with. In case of failure to observe the above regulations while undertaking the job safety officer/engineer in charge can order for stopping of work.

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SPEC NO. 203: ERECTION SCHEDULE

Schedule for Erection and Commissioning of 1X80 MW TG Auxiliaries and piping shall be tentatively as follows:

- | | | |
|--------------------------------------|----------|-----------------------|
| 1. Site opening | : | July'2012 |
| 2. Commissioning of Turbine | : | November' 2012 |
| 3. Load run and stabilization | : | December' 2012 |

For the purpose of contract, the period shall be taken as 9 months. Completion of the work shall be as per BHEL Bar Charts revised from time to time. In order to expedite the work, the contractor has to deploy manpower on two-shift basis during erection and during pre-commissioning and commissioning period manpower should be provided round the clock basis as per site requirement without any extra cost to BHEL.

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SPEC NO. 204

1.01.0 ERECTION, TESTING COMMISSIONING AND PAINTING

| S.NO | Description | No of items | Quantity | | Rate Rs/ Kg | Amount Rs |
|---------|-----------------------------|-------------|----------|---------------|----------------|-----------|
| | | | WT | Total wt | | |
| 1.01.01 | Turbine | | | 120700 | | |
| 1.01.03 | Generator | | | 145460 | | |
| 1.01.04 | Lube oil tank | 1 | 5500 | 5500 | | |
| 1.01.05 | Lube Oil Pump Assembly | 2 | 1100 | 2200 | | |
| 1.01.06 | Lube Oil Cooler | 2 | 3100 | 6200 | | |
| 1.01.07 | Lube oil filters | 2 | 500 | 1000 | | |
| 1.01.08 | Emergency Oil Pump Assembly | 1 | 700 | 700 | | |
| 1.01.09 | Overhead Lube Oil tank | 1 | 3000 | 3000 | | |
| 1.01.10 | J.O.P | 2 | 1000 | 2000 | | |
| 1.01.11 | Gov. Oil Console | 1 | 1000 | 1000 | | |
| 1.01.12 | Valves | -- | 4000 | 4000 | | |
| 1.01.13 | Oil Accumulators and | 1 set | 600 | 600 | | |
| 1.01.14 | Vapour Extn Fan | 2 | 200 | 400 | | |
| 1.01.15 | Oil Centrifuge | 1 | 1000 | 1000 | | |
| 1.01.16 | Gland Steam Condenser | 1 | 1100 | 1100 | | |
| 1.01.17 | L.P.Heater | 2 | 7750 | 15500 | | |
| 1.01.18 | H.P.Heater-1 | 1 | 11500 | 11500 | | |
| 1.01.19 | H.P.Heater-2 | 1 | 12000 | 12000 | | |
| 1.01.20 | Drain cooler | 1 | 5200 | 5200 | | |
| 1.01.21 | Spray tray deaerator | 1 | 32000 | 32000 | | |
| 1.01.22 | QCNRV and Other Valves | | | 15000 | | |
| 1.01.23 | Structural | 1 | 5000 | 7000 | | |
| | | | Total wt | 393060 | | |
| | | | | Kg | | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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Notes:

1. The Turbine and Generator will be dispatched to site in dismantled conditions. Bidders to note that turbine, Generator erection include the assembly of turbine and generator at site in position, with proper foundation. 120 Ton EOT Crane will be made available for Erection of Turbine and Generator.
2. The LP and HP heaters (2 nos), Deaerator (in 3 pieces), Gland Steam Condenser, erection includes fabrication and welding of stand pipes, instruments isolation valves, flanges etc.
3. Erection rates of pipes sizes dia 48.3 and below includes fit up, welding, radiography, wherever applicable and welding of instrument isolation valves, flanges, for thermowells, stubs etc on all pipes and equipment. Alloy steel pipe weld joints rate to be quoted including Stress relieving.
4. Thermal insulation for valves, elbows tees and other fittings are already included in the length indicated. The unit rated quoted for insulation of piping shall include for valves, elbows, tees and other fittings. And no separate payment shall be made for these items.

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1.02.0 Pipe fit up and welding

| Sr No | Size | Material | Weld type | No of joints | Rate in Rs | Amount in Rs. |
|-----------------------------|--------------|----------|-----------|--------------|------------|---------------|
| IBR PIPING | | | | | | |
| Alloy steel piping | | | | | | |
| 1.02.01 | 4" Sch 40 | A335 P11 | TIG+SMAW | 6 | | |
| 1.02.02 | 6"Sch40 | A335 P11 | TIG+SMAW | 44 | | |
| 1.02.03 | 6"Sch80 | A335 P22 | TIG+SMAW | 22 | | |
| Carbon steel pipe | | | | | | |
| 1.02.04 | 2" Sch 40 | A106GRB | TIG+SMAW | 4 | | |
| 1.02.05 | 4" Sch 40 | A106GRB | TIG+SMAW | 8 | | |
| 1.02.06 | 6" Sch 40 | A106GRB | TIG+SMAW | 99 | | |
| 1.02.07 | 8" Sch 20 | A106GRB | TIG+SMAW | 75 | | |
| 1.02.08 | 10" Sch 20 | A106GRB | TIG+SMAW | 6 | | |
| 1.02.09 | 12" Sch 20 | A106GRB | TIG+SMAW | 60 | | |
| 1.02.10 | 14" Sch 30 | A106GRB | TIG+SMAW | 31 | | |
| 1.02.11 | 20" Sch 20 | A106GRB | TIG+SMAW | 33 | | |
| 1.02.12 | 6" Sch 120 | AA10634 | TIG+SMAW | 12 | | |
| NON IBR PIPING | | | | | | |
| Carbon steel pipe | | | | | | |
| 1.02.13 | 12" Sch 20 | A106GRB | TIG+SMAW | 25 | | |
| 1.02.14 | 8" Sch 20 | A106GRB | TIG+SMAW | 27 | | |
| 1.02.15 | 6" Sch 40 | A106GRB | TIG+SMAW | 52 | | |
| 1.02.16 | 6" Sch 20 | A106GRB | TIG+SMAW | 93 | | |
| 1.02.17 | 4" Sch 40 | A106GRB | TIG+SMAW | 108 | | |
| 1.02.18 | 3" Sch 20 | A106GRB | TIG+SMAW | 94 | | |
| 1.02.19 | 2" Sch 40 | A106GRB | TIG+SMAW | 7 | | |
| 1.02.20 | 1.5" Sch 40 | A106GRB | TIG+SMAW | 16 | | |
| Stainless steel pipe | | | | | | |
| 1.02.21 | 4" Sch 10S | SS321 | TIG | 74 | | |
| 1.02.22 | 3" Sch 10S | SS321 | TIG | 59 | | |
| 1.02.23 | 2" Sch 20S | SS321 | TIG | 40 | | |
| 1.02.24 | 1.5" Sch 40S | SS321 | TIG | 21 | | |
| 1.02.00 TOTAL | | | | | | |
| | | | | | | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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1.03.0 Radiography of piping

| Sl no | Size | Matl/type of weld | No of Joints | Rate in Rs. | Amount in Rs. |
|-----------------------|--------------|-------------------|--------------|-------------|---------------|
| IBR | | | | | |
| 1.03.01 | 1" Sch 80 | A335 P11 | 17 | | |
| 1.03.02 | 4" Sch 40 | A335 P11 | 6 | | |
| 1.03.03 | 6"Sch40 | A335 P11 | 44 | | |
| 1.03.04 | 6"Sch80 | A335 P22 | 22 | | |
| 1.03.05 | 1" Sch 80 | A106GRB | 14 | | |
| 1.03.06 | 1" Sch 20 | A106GRB | 1 | | |
| 1.03.07 | 2" Sch 40 | A106GRB | 1 | | |
| 1.03.08 | 4" Sch 40 | A106GRB | 2 | | |
| 1.03.09 | 6" Sch 40 | A106GRB | 20 | | |
| 1.03.10 | 8" Sch 20 | A106GRB | 15 | | |
| 1.03.11 | 10" Sch 20 | A106GRB | 2 | | |
| 1.03.12 | 12" Sch 20 | A106GRB | 12 | | |
| 1.03.13 | 14" Sch 30 | A106GRB | 6 | | |
| 1.03.14 | 20" Sch 20 | A106GRB | 7 | | |
| 1.03.15 | 6" Sch 120 | AA10634 | 12 | | |
| NON IBR PIPING | | | | | |
| 1.03.16 | 12" Sch 20 | A106GRB | 3 | | |
| 1.03.17 | 8" Sch 20 | A106GRB | 3 | | |
| 1.03.18 | 6" Sch 40 | A106GRB | 5 | | |
| 1.03.19 | 6" Sch 40 | A106GRB | 5 | | |
| 1.03.20 | 4" Sch 40 | A106GRB | 9 | | |
| 1.03.21 | 3" Sch 20 | A106GRB | 10 | | |
| 1.03.22 | 4" Sch 10S | SS321 | 9 | | |
| 1.03.23 | 3" Sch 10S | SS321 | 1 | | |
| 1.03.24 | 2" Sch 20S | SS321 | 2 | | |
| 1.03.25 | 1.5" Sch 40S | SS321 | 7 | | |
| 1.03.00 TOTAL | | | | | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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1.04.00 PIPING ERECTION INCLUDING SPRING HANGERS, SUPPORTS, HYDRAULIC TESTING AND PAINTING

| IBR PIPING | | | | | |
|-------------------|------------------|--------------|--------------------|--------------------|----------------------|
| SL.NO. | Pipe size | Matrl | Length Mtrs | Rate in Rs. | Amount in Rs. |
| 1.04.01 | 1" Sch 80 | A335 P11 | 240 | | |
| 1.04.02 | 4" Sch 40 | A335 P11 | 6 | | |
| 1.04.03 | 6"Sch40 | A335 P11 | 60 | | |
| 1.04.04 | 6"Sch80 | A335 P22 | 40 | | |
| 1.04.05 | 8"Sch40 | A335 P11 | 6 | | |
| 1.04.06 | 1" Sch 80 | A106GRB | 10 | | |
| 1.04.07 | 1" Sch 20 | A106GRB | 20 | | |
| 1.04.08 | 2" Sch 40 | A106GRB | 12 | | |
| 1.04.09 | 4" Sch 40 | A106GRB | 76 | | |
| 1.04.10 | 6" Sch 40 | A106GRB | 135 | | |
| 1.04.11 | 8" Sch 20 | A106GRB | 97 | | |
| 1.04.12 | 10" Sch 20 | A106GRB | 6 | | |
| 1.04.13 | 12" Sch 20 | A106GRB | 78 | | |
| 1.04.14 | 14" Sch 30 | A106GRB | 48 | | |
| 1.04.15 | 20" Sch 20 | A106GRB | 48 | | |
| 1.04.06 | 6" Sch 120 | AA10634 | 16 | | |
| NON IBR | | | | | |
| 1.04.17 | 12" Sch 20 | A106GRB | 30 | | |
| 1.04.18 | 8" Sch 20 | A106GRB | 30 | | |
| 1.04.19 | 6" Sch 40 | A106GRB | 66 | | |
| 1.04.20 | 6" Sch 20 | A106GRB | 114 | | |
| 1.04.21 | 4" Sch 40 | A106GRB | 92 | | |
| 1.04.22 | 3" Sch 40 | A106GRB | 154 | | |
| 1.04.23 | 2" Sch 40 | A106GRB | 37 | | |
| 1.04.24 | 1.5" Sch 40 | A106GRB | 30 | | |
| 1.04.25 | 4" Sch 10S | SS321 | 120 | | |
| 1.04.26 | 3" Sch 10S | SS321 | 40 | | |
| 1.04.27 | 2" Sch 20S | SS321 | 82 | | |
| 1.04.28 | 1.5" Sch 40S | SS321 | 36 | | |
| 1.04.29 | 1" Sch 40S | SS321 | 172 | | |
| 1.04.30 | 3/4" Sch 40S | SS321 | 41 | | |
| 1.04.31 | 1/2" Sch 40S | SS321 | 162 | | |
| 1.04.00 | | | | | |
| TOTAL | | | | | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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1.05.00 THERMAL INSULATION (APPLICATION) INCLUDING CLADDING, FIXING ARRANGEMENTS ETC.

| Sr No. | Pipe OD mm | Insulation th.in mm | Length - Mtrs | Rate Rs | Total |
|---------|-----------------------|---------------------|---------------|--------------|-------|
| 1.05.01 | 508 | 75 | 53 | | |
| 1.05.02 | 356 | 75 | 53 | | |
| 1.05.03 | 323 | 75 | 86 | | |
| 1.05.04 | 273 | 75 | 7 | | |
| 1.05.05 | 219 | 90 | 107 | | |
| 1.05.06 | 168 | 150 | 22 | | |
| 1.05.07 | 168 | 75 | 209 | | |
| 1.05.08 | 114 | 75 | 90 | | |
| 1.05.09 | 60 | 50 | 13 | | |
| 1.05.10 | 33 | 50 | 277 | | |
| | | | | | |
| | Equipment | | | | |
| 1.05.11 | Gland steam condenser | | 8.50 | | |
| 1.05.12 | H.P.Heater-1 | | 40.00 | | |
| 1.05.13 | H.P.Heater-2 | | 35.00 | | |
| 1.05.14 | L.P.Heater-1 | | 31.00 | | |
| 1.05.15 | L.P.Heater-2 | | 30.00 | | |
| 1.05.16 | De aerator | | 185.00 | | |
| 1.05.17 | Drain cooler | | 8.00 | | |
| | | | | Total | |

Thermal insulation for valves elbows, Tees & fittings are already included in the length indicated The unit rate quoted for insulation of piping shall include for valves, Elbows, Tees & other fittings also and no separate payment shall be payable for these items.

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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1.06.00 MATERIAL UNLOADING AND STACKING

| DESCRIPTION | | WEIGHT (Tons) | RATE RS/TON | TOTAL |
|----------------------|--|------------------|-------------|-------|
| 1.06.01 | MECHANICAL ITEMS | 528 | | |
| 1.06.02 | INSTRUMENTSTION AND ELECTRICAL, PANELS. CABLE DRUMS ETC. | 40 | | |
| 1.06.00 TOTAL | | | | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

BHARAT HEAVY ELECTRICALS LTD- HYDERABAD
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SUMMARY

| | |
|---|--|
| EQUIPMENT ERECTION INCLUDING COST OF GROUTING (1.01.00) AND PAINTING | |
| FIT UP AND WELDING (1.02.00) | |
| RADIOGRAPHY OF PIPING JOINTS (1.03.00) | |
| PIPING ERECTION INCLUDING SPRING HANGERS SUPPORTS & PAINTING (1.04.00) | |
| THERMAL INSULATION (APPLICATION) INCLUDING CLADDING, FIXING ARRANGEMENTS ETC (1.05.00) | |
| MATERIAL UNLOADING (1.06.00) | |
| GRAND TOTAL | |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

BHARAT HEAVY ELECTRICALS LTD- HYDERABAD
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SPEC NO. 205 A

MAN HOUR RATES:

Bidder shall consider the following single man-hour rate including cost of supervision and consumables for all categories of extra works that may arise during the course of contract. Bidder to note that these rates shall not be applicable for modification / rectification of works executed defectively contrary to the instruction of engineers and drawing. Bidder to note that same man hour rate shall be applicable for overtime working also.

| Sl.No. | DESCRIPTION | MAN HOUR RATE |
|---------------|------------------------------------|----------------------|
| 1. | SKILLED / UNSKILLED WORKMEN | Rs 25/- |

Note: The above rates are exclusive of govt. service taxes, which are to be paid extra.

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OIL PIPING

- 1) All dimensions /elevations refer to C.L. of pipe lines unless otherwise specified.
- 2) a) Pipe routing shall be done strictly as per drawing. Wherever dimensions are not specified same may be routed as per site convenience.
b) Pipe nominal size 2" and below shall be routed as per site convenience unless otherwise specified in the drawing.
- 3) a) Fusion faces shall be as per plant standard No. HY0620599.
b) Weld edges shall be debarred before welding.
- 4) Follow the following WPS Nos. for weld joints:
Carbon steel (SA 106-B or Eq): WE 003/A2 Stainless steel (A312TP 321 or Eq):WE-313/A2 or A1.
- 5) 10% of welds selected at random shall be tested with liquid penitent
- 6) Drain lines / return headers shall be erected with a slope of 1 Deg in the direction of flow.
- 7) All hangers are of rigid type unless otherwise specified. Small bore pipes shall be Fixed with clips to the nearest structure suitably. For suspension supports refer PGMA No.31322.
- 8) Orifices shall be erected after oil flushing.
- 9) Pipes shall be thoroughly cleaned during erection and should be acid pickled as per drawing No.4-170552 after the lines are completely erected and hydraulically tested.
- 10) Hydraulic test shall be conducted on complete pipe lines (except drain lines) at 1.5 times the max. working pressure before acid pickling.
- 11) After cleaning, all pipes shall be painted as per plant standard No.HY 0674162, unless otherwise specified.

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CLEANING AND PAINTING OF LUBE OIL **(CARBON STEEL AND STAINLESS STEEL)**

Scope: This standard covers the pickling and painting requirement of Carbon Steel Piping and pickling requirements of Stainless Steel Piping.

- 1.0 Mechanical cleaning for Carbon Steel and Stainless Steel Piping.
- 2.1 Mechanical cleaning consists of removing scales, welding spatters, rust, earth residues, previous painting or any other deposits adhering to the metal surface by means of wire brushes, wheels or pneumatic chisel or other similar methods while taking care not to damage the piping metal surface.
- 2.0 **Flushing:** Initially flush the C.S. and S.S. pipe lines with water at 70o C for about one hour.
- 3.0 Degreasing of C.S. and S.S. Pipe lines.
- 4.1 **Purpose:** For removal of any oil, grease etc., which may be adhering to the metal surfaces of line.
- 4.2 **For degreasing:** A solution containing 15% caustic soda and 15% sodium Phosphate in water at 80oC shall be used. The solution shall be kept agitated during degreasing.
- 4.0 **Flushing:** The C.S. and S.S. Pipe lines shall be flushed with hot water at 80o C for 1 hour.
- 5.0 Pickling of Carbon Steel Pipe Lines.
- 6.1 Use a mixture of sulphuric Acid and Hydrochloric Acid. The strength of the pickling solution depending on the surface condition of the part to be treated. The concentration may be up to 20% and temperature can be 20 to 65o C. Duration of pickling shall be 24 hours or use 5% sulphuric acid or use 20% Hydrochloric Acid.
- 6.2 **Washing:** The pipelines shall be flushed with water.
- 6.3 **Neutralization :** In alkaline solution consisting of caustic soda 5% Benzoate 2 to 3% and sodium Nitrate 10% . The PH values of the solution shall be PH 8-10. T. No-time lapse should be allowed between articles 6.2 and 6.3 above. Or 2% phosphoric acid can also be used for Neutralization.
- 6.4 **Drying:** Immediately after neutralization pipe lines shall be dried with compressed air which is free from oils and humidity.
- 6.5 **Protection :** If the pipe lines are not put into service within few days of above treatment, they shall be protected by Anti-oxidizers and fill with Nitrogen.
- 7.0 Pickling of stainless steel pipe lines.
- 7.1 A solution of 7% by vol. of Industrial Nitric Acid and 3% by vol. of industrial sulphuric acid in water at 50o C shall be used for pickling for half an hour.

or

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A solution containing citric acid 8% by Wt. and Rodine 92 A or 130 (Powder) 1-5% by wt. in water at 65oC to 70o C shall also be used for Pickling for 12 hours. However citric acid is preferable.

7.2 Same as Art. 6.2 above (Washing)

7.3 Same as Art.6.3 above. (Neutralization)

7.4 Same as Art 6.4 above(Drying)

7.5 Same as Art.6.5 (Protection).

8.0 Painting of CS. Pipe lines.

8.1 Pipe lines shall be cleaned by wire brushing also see Art.2.1 for details.

8.2 Anti-corrosive painting.

Apply 4 coats of anticorrosive paint DURALIT SR 1.423. 2201 of MAX MAYER or its equivalent APCODUR CP 684 yellow with its suitable thinner No.121. The total thickness of dry film shall be around 0.2mm.

8.3 Finish paint.

Apply one coat of DURALIT ISC series 431 (1.431-8176) of MAX MAYER) or its euivalent

APCODOUR CF 692 ADUIRALTY GREY by adding suitable thinner No.181, The thickness of dry film shall be around 0.04mm.

9.0 Stainless steel surfaces do not re quire painting.

**GENERAL INSTRUCTIONS FOR ACID CLEANING (PICKLING) OF
PIPE LINES OF OIL SYSTEM
(TURBO COMPRESSOR AND TURBO GENERATOR SETS)**

1.0 GENERAL:

The purpose of acid cleaning (pickling) is to remove the rust resulted due to long Exposure to the atmospheric conditions and for dislodging the burs, welding slag and the mil scales adhering to the internal surface of the pipe lines. The oil pipe lines include lubricating oil pipe lines, governing oil pipe lines, seal oil system pipe lines and all the drains.

After completing the fabrication of piping for the oil circuit, the pipes shall invariably be pickled. (Note : sand blasting method shall not be resorted to). It is always desirable that this operation is carried out by a reputed agency which is specialized in pickling pipe work. If this is not possible due to any reasons, the following procedures are recommended. The activities involved for this process are given below with detailed procedures in sequential manner.

- 2.0 Methods of pickling pipe lines material wise.
 - 2.1 Carbon steel and alloy steels.
 - 2.2 Stainless steel; and steels with high chromium content.
- 3.0 Preparation at site.
 - 3.1 Mechanical cleaning of oil pipe lines.
 - 3.2 Hydraulic testing of oil pipe lines.
 - 3.3 Steam blowing of oil pipe lines.
 - 3.4 Assembly of oil pipe lines for acid cleaning.
 - 3.5 Pressure testing of contours (loops).
- 4.0 Flushing of the contour with hot water.
- 5.0 Quantity of acid solution and acid cleaning process.
 - 5.1 Circulation process.
 - 5.2 Soaking /filling process.
- 6.0 Flushing with hot water after pickling and neutralization.
- 7.0 Dis-assembly of contours and dry compressed air blowing.
- 8.0 Oil spraying of the pipe sections.
- 9.0 Safety precautions.
- 10.0 Approximate material requirement.

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2.0 METHODS OF PICKLING PIPE LINES MATERIAL WISE.

2.1 Material: carbon steels & alloy steels.

| | | |
|---|--|-------------------------------------|
| a) Hot water flushing | D.M. water | Item under hot water flushing. |
| b) Degreasing with an Alkaline solution | Alkaline solution consisting of 50 gms. Of tri-sodium phosphate, 50 gms. of sodium carbonate, 20 gms of caustic soda per 1 ltr of water at 80 deg. C circulation /filling for 2hrs. at 70 to 80 deg.C | Item under circulation process |
| c) Hot water flushing after degreasing. | Hot water circulation for one hour at 70 to 80 deg.C | Item under hot water flushing. |
| d) Acid cleaning with | Acid solution consisting of HCL at 10% concentration inhibitor of 1% by volume Other inhibitors like 1% Forma-line or 3% pyridine can also be used. (say roudine 213) and the rest with water at temp 70 | Refer item under circulation method |
| <p>Note: Other acid solutions which are less frequently used are:</p> <ul style="list-style-type: none">i) Sulphuric acid 10 to 15% concentration; soaking period 1 hour.ii) Phosphoric acid of 30 to 40% concentration; soaking period 10 hours <p>It is not advising to use NITRIC ACID SOLUTIONS for this Process.</p> | | |
| e) Hot water flushing After acid cleaning. Hot water flushing at 70 to 80 C for one hour. | | |
| f) Neutralisation: After acid cleaning to neutralize the acid a solution of 5 to 10% of caustic soda of 50 gms of Trisodium Phosphate mixed in one liter of water maintained at 40 to 50 Deg. C. can be used. Circulation may be for one hour. Soaking period may be 10 to 20 minutes. However, it is to be continued till the PH value of the solution reaches to the required value of about 8 to 10. | | |
| g) Hot water flushing: Hot water circulation at 80 Deg C for one hour. | | |
| h) Dry with | Air blowing with compressed Air free from oil, moisture etc | Ref. item under air blowing |
| i) Protecting the interior with | 1) Filling the loops with oil and spraying the oil inside the pipes which are not included in the loops 2) Cleaning the pipe ends with cloth | |

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2.2 Material : Stainless steel and steels with high chromium content.

| ACTIVITY (1) | COMPOSITION AND OTHER DETAILS (2) | FOR DETAILED PROCEDURES REFER ITEMS (3) |
|--|---|--|
| a) Hot water washing | D.M.water circulation at about 80Deg C for one hour. | |
| b) Degreasing with | i) Solution consisting of 15% caustic soda Alkaline solution. plus 15% sodium phosphate per litre of circulation item. Water at 80 Deg C.or ii) Solution consisting of 50 gms trisodium phosphate 50 gms. Of sodium carbonate and 20 gms. Caustic soda per one litre of water at 70 Deg. To 80 Deg.C. CIRCULATION :2 hrs. | Refer pickling |
| c) Hot water flushing after degreasing | Circulation at 80Deg. C for one hour. | Refer circulation |
| d) PICKLING: | i) Cleaning with a solution of 7% (by volume) industrial Nitric acid and 3% (by volume) filling industrial sulphuric acid and 90% (by volume water at 50 Deg.C for 30 minutes). ii) Preferably pickling of stainless steel piping may be done with solution containing Citric Acid 6% (by weight),Redine 92 A or 130 (Power) 1.5% (by weight) at a temperature of 65 Deg to 70 Deg.C 12 hours circulation method. | |
| e) Hot water flushing | Circulation at 80 Deg.C for one hour. | |
| f) Neutralisation | Solution of 10% Caustic soda and 90% Circulation for one hour. | |
| g) Hot water flushing | Circulation at 80 Deg.C for one hour. | |
| h) Dry with: | Air blowing with compressed air free from oil, moisture etc. | |
| i) Protecting the interior with | i) Filling the loops with oil and spraying the oil inside the pipes which are not included in the loops. ii)Closing the pipe ends with cloth. | |

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3.0 PREPARATION AT SITE:

3.1 MECHANICAL CLEANING OF OIL PIPE LINES;

All the pipe sections are thoroughly cleaned with the help of round wire brushed of proper sizes and chains. The tee branches, reducers, bends are cleaned with greater care. Wherever possible the excess of welding metal protruding over the internal surface of the pipe sections are to be removed by grinding or with the help of hand files. After cleaning is done the pipe sections are blown with compressed air to remove the dirt or dust.

The cleaning is continued till all the rust, loose materials, welding burrs, slugs are dislodged and removed. All the joining flanges of the pipe lines are to be scraped and colour matches with the surface plate.

3.2 HYDRAULIC TESTING OF OIL PIPE LINES:

After the successful mechanical cleaning, the pipe lines are hydraulic tested at the recommended pressure and the test results are to be recorded. Maximum possible pipe line sections which form the complete contour are assembled temporarily on a leveled ground for the purpose of hydraulic testing. The selection of sections have to be done from the point of convenience. Pipe sections which can not be included in the contours have to be tested individually. This test is inevitably required for all the high pressure pipe line sections included in the seal oil system.

3.3 STEAM BLOWING OF OIL PIPE LINES:

All the pipe sections which can not be mechanically cleaned are to be steam blown in two stages. The steam required for blowing is obtained from the existing units of a package boiler where no Unit exists. The parameters of the steam used for blowing are 7 to 8 Kg./cm², temperature of 180 To 200 deg. cent. Minimum flow to be maintained during process is 4 to 5 t/hr. Duration of each Blow shall be 15 to 20 minutes. The second blowing is given after cooling the pipe sections to the ambient temperature. The blowing further ensures the removal of all the loose materials, welding slag adhering to the internal surface of the internal surface of the pipe sections.

3.4 ASSEMBLY OF OIL PIPE LINES FOR ACID CLEANING;

Note : Pipe sections of diameter 80mm below are not to be included in the contour. They are acid cleaned by soaking process. Soaking filling method can be done wherever the circulation process is not possible due to air locks and also depending on the loops prepared.

The pipe sections are assembled in different contours on a leveled ground and supported over Wooden sleepers at number of places near the joints. The selection of sections has to be done From the point of convenience. Where parallel flow paths are unavoidable, orifices shall be Provided restrict to flow in the path offering the least resistance for the flow. The contours Shall

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have to be provided with drain points for draining the solution and air vent for removal of air. While charging with the solution. The cleaning of the front pedestal inner oil pipe lines is not done by acid. They are only mechanically cleaned and steam blown. The contours are to be provided with sampling points both a suction and return lines for facilitating the collection samples for analysis.

The contours are also to be provided with valves in suction and return ends for regulating The flow. A drain line to the neutralizing pit with a valves is to be provided before the valve on the return line. A by pass line is also provided for the contour with a valve for facilitating the starting of the acid pumps. All the pipe sections joints are to be provided with acid resistance rubber gaskets only. Wherever temporary pipe lines or blank required, will be provided.

3.5 PRESSURE TESTING OF CONTOURS:

Contours assembled are hydraulic tested with one discharge to the dissolving tank to check for the tightness of all the joints.

4.0 FLUSHING OF THE COUNTOUR WITH HOT WATER.

Hot water flushing of the contours are carried out with filter water prior to acid circulation process in order to remove the dust, dirt or moll scales.. This also helps to check the tightness of all the flanged joints under hot conditions. The filter water is first taken into the dissolving tank and head to a temperature of 60 deg. C by passing steam. The parameter of the steam admitted shall be 8kg.cm² and temperature of 180 to 200 deg.C. The acid circulation pump is then started on re-circulation and further the temp. of the water in the dissolved tank is raised to 70 deg.C by passing more quantity of steam. The air valve provided in the contour is opened and the suction valve of the contour is opened slowly for charging the contour. When all the air is expelled out of the contour, the water starts coming out in the form of a jet from the air vent. After ensuring the complete removal of the air, the air valve is closed and the discharge valve of the contour to the neutralizing pit is opened slowly and the storage tank maintained at a constant level i.e.3/4th gauge throughout the process. The rate of discharge of water to be maintained at 50 t/hr. This quantity may vary from set to set. The approximate time required for the completion of the process is three hours.

5.0 QUANTITY OF ACID SOLUTION AND ACID CLEANING PROCESS:

5.1 SAMPLE CALCULATIONS:

The quantity of acid to be used for cleaning a contour depends upon the volume of contour /piping loop. A sample calculation to arrive at the required quantity of acid for a contour of 6 m³ volume is given below. However, the total quantity of acid required will depend upon the total volume of pipe lines to be cleaned which varies from set to set. .

Volume of contour = 6 m³ The dissolving tank volume is of say =2 m³.

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The working volume of the tank is taken as 10 m³ as the level is to be maintained at ½ of the level gauge glass.

Total volume = 6 + 10 = 16 m³

If acid concentration is chosen as 15% of phosphoric acid (H₃ P₀₄).

For 80% concentration of H₃ P₀₄:

Commercially available quantity of acid required is = 2.4/0.8 = 3 m³. Specific gravity of acid required is 1.75. Weight of H₃ P₀₄ required for 6 m³ contour cleaning is = 1.75 x 3 = 5.25 MT.

5.2 PREPARATION OF SOLUTION AND PROCESS OF CIRCULATION METHOD:

Demineralised water is filled in to the dissolving tank up to the lower gauge glass full. One of the acid circulation pump is started on recirculation through the contour/pipe loop. The temperature of the tank water is raised to 50 deg. Cent. By passing of steam in to the dissolving tank.

Just after the temperature of 50 deg.cent. is attained, the addition of the calculated quantity of acid, a sample from suction of the contour is sent to laboratory for checking required concentration . The temperature of 60 to 80 deg.cent. is maintained throughout the process by controlling required steam quantity. The parameter of the steam is 7 to 8 Kg/cm² and temperature 180 to 200 deg.cent.(care is to be taken to see that the tank level does not increase more than 1 ¾ level gauge glass. The closed circulation of the acid solution is continued for 6 hours after the complete addition of the acid.

During the circulation hourly samples are taken from the suction and return lines and analysed for the following:

- 1) PH
- 2) acidity
- 3) Iron content.

NOTE: The concentration of the acid and type of acid chosen may vary depending upon the material and cleanliness of the pipe lines. Refer item for method of pickling noted.

After the successful completion of the 6 hours circulation the pumps are stopped. The contour is allowed to soak with the solution for one hour. This is called the “Locking of the process”. The circulation is resumed once again for about 15 to 20 minutes and the process is locked for 5 minutes. This operation is repeated for 3 to 4 times to dislodge the extraneous matter that might have been stuck up at the sharp bends of the contour. Even during this locking process, Samples are taken from the suction return lines and analysed as earlier.

Then the complete solution is discharge in to the neutralizing pit first through the pump and then by gravity after stopping the pump. The contour is also drained. While discharging the acid solution, it is neutralized by adding NaOH in to the neutralizing pit.

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5.3 SOAKING PROCESS/FILLING PROCESS:

The pipe sections of diameter 80mm and below which are included in the contour are acid cleaned (pickled) by “soaking process”. This method comprises of blanking one end of the pipe sections completely and filling up of the acid solution prepared with the required concentration. After the pipe section is filled with the acid solution, the other end is also blanked loose to allow the gases to escape.

In some cases, all the small bore pipe sections and other small branches are completely immersed in the tank for digressing, pickling and neutralization and it is ensured that all the pipes are filled inside fully with the solution. In both the methods, it is to be left for 24 hours and after which the solution is drained out from the pipe sections. These were finally blown by steam and air.

6.0 FLUSHING OF THE CONTOUR WITH D.M.WATER:

After the system is completely drained the dissolving tank is filled with the D.M.. Water and the water in the tank is put on recirculation through the acid pump. The contour is slowly charged end the water is put on recirculation through the contour and the bypass valve of the contour is closed. The temperature of the D.M. water of the dissolving tank is raised to 70 to 80 deg. Cent. by passing steam of 7 to 8 Kg/cm² and temperature of 180 to 200 deg. Cent. The discharging valve of the contour to the neutralizing pit is slowly opened and the hot flushing of the contour is started. The recirculation valve to the tank is closed. The rate of discharge to the neutralizing pit is maintained at 50t/hr. This quantity may vary from set to set. The dissolving tank is mad up continuously with D.M. water and the constant level of 1 ¾ gauge glass is maintained. The hourly samples from the discharge line is collected and analyzed for the following:

- 1) PH 2) CONDUCTIVITY 3) ACIDITY 4) IRON CONTENT.

The temperature of the water at the dissolving tank is maintained at 70 to 80 deg. Cent. Throughout the process. The rinsing of the contour is deemed to be over when the acidity and iron content becomes nearly equal over a set of consecutive readings of zero. The pipe sections which are soaked are also booked in to contours and rinsed with D.M.water as above or the pipe sections are steam washed till such results as above are obtained. The approximate time required for the above process is 8 hours.

7.0 DESSEMBLY OF CONTOUR AND DRY COMPRESSED AIR BLOWING:

Soon after completing the D.M.water rinsing the pipe sections of the contour are disassembled and taken over a platform where the arrangement for dry compressed air is made compressed air is made available for blowing. The temperature of the compressed air used shall be 50 deg. Cent. And the pressure 3 50 4Kg/cm². The clean dried surface has a dark steel gray colour, which indicates that the acid cleaning is of required standard.

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8.0 OIL SPRAYING OF THE PIPE SECTIONS:-

The dry pipe sections are then sprayed with DTE medium oil for protecting them from further rusting till they are erected back. For this purpose oil is thrown in to the pipe section using a small container and blown with compressed air. The end of the pipe sections are covered with wooden blanks to prevent the entry of the dust. The method of preservation is adopted when the cleaned pipe lines are required to be stored for 1 to 2 months. This is called the “passivation”.

9.0 SAFETY PRECAUTIONS TO BE TAKEN DURING AND AFTER ACID CLEANING:

- 1) The acid cleaning area shall be maintained free from foreign materials which may obstruct the movement of the personnel.
- 2) Ensure that the persons working in the acid cleaning process use the following:
 - a) Rubber gloves
 - b) Goggles
 - c) Aprons
 - d) Gum boots
 - e) Masks
- 3) Ensure the availability of first aid box, eye drops neutralizing bottle and cotton rolls.
- 4) The pipe sections after acid cleaning are to be stored properly so that no moisture or dust enters in to them till erected.
- 5) Smoking is strictly prohibited in the area where acid cleaning is done, no fire should be lit around the area.
- 6) Drilling, cutting, Welding of the pipe sections are strictly prohibited after the acid cleaning. All the stubs for instrument tapings are hence to be provided before acid cleaning and properly Plugged during and after acid cleaning till erected.
- 7) The damaged bolts and nuts during acid cleaning shall be replaced by new ones.
- 8) Due precautions to be taken while tightening the joints of the loop so that they do not leak.

10.0 MATERIAL REQUIREMENT (VARIES FROM-SET TO SET):

- 1) Quantity of filter water: 1250 MT
- 2) Quantity of D.M.Water: 1900 MT

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- | | | |
|----|--|--|
| 3) | Quantity of acid: | 16.5 MT |
| 4) | Quantity of steam for heating the solution etc.: | 150 MT |
| 5) | Quantity of Na OH: | 3 MT |
| 6) | Capacity of dissolving tank: | 20 m ³ |
| 7) | Acid pumps: | 100m ³ /hr 10Kg/cm ² 4Nos. |
| 8) | Hot air blower: | 1No. |
| 9) | Thermometer (dial type): | 0 to 100 Deg.C. 1No. |

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OIL FLUSHING FOR TG SETS

1. GENERAL

After completion of fabrication, acid pickling and installation the entire oil system should be thoroughly flushed, in order to eliminate all the contaminants, which might have been introduced into the oil system during the erection operations.

Acid pickling (write up Ref.No.4-17-0552) would have already removed all the Residual impurities from the oil system. However, oil flushing is to be carried out to be more sure that no foreign material will be carried by the oil to the bearings and governing elements, which is dangerous to the turboset.

During oil flushing, high velocity of flow in the oil lines can be achieved by temporarily removing the throttling points in governing line and opening the bearing inlet orifices such that drain oil pipe is 2/3 full. These high velocities will help in detaching loose particles Adhering to the pipe walls, so that they will be carried away by the oil flow.

2. FLUSHING OIL:

Oil system can be flushed with the same type of oil that is employed for normal turbine operation

Oil quantity required for flushing is approximately 60% to 70% of the quantity of oil required for normal operation of the turbine. However it has to be ensured that the oil pump does not starve for oil at its suction, during flushing.

After completion of flushing, the oil has to be centrifuged by centrifuging equipment and then tested. From the test results it can be decided whether the oil, after being used for flushing, is still usable as turbine lubricant.

NOTE: Other types of cleaning agents, especially chemical detergents, must never be used for flushing operations.

3. PREPARATION FOR START UP:

OIL TANK: Before filling with oil, the oil tank and strainer are to be thoroughly cleaned. Only cloth but never cotton waste, should be used for cleaning.

The cleaning materials used, should not leave any residue, and then the tank is to be loaded up with oil.

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LUBRICATING OIL CIRCUIT:

- a) All the adjustable orifices are to be opened such that drain oil pipes are 2/3 full.
- b) All filter cartridges in lube oil filter are to be removed.
- c) Upper halves of the radial bearings are to be taken out. Journal portion is to be covered with cloth leaving the hole space for oil inlet. The cloth is to be pressed in between the bearing covers such that it will not become loose and pass on along with oil.
- d) Thrust bearing is to be removed.
- e) Proper tightening of all the flanges is to be ensured.
- f) Flushing of delivery pipe lines of the other oil pumps which are not used for flushing operations can be done by connecting their delivery pipe lines to the oil tank before the strainers.
- g) The delivery lines of jacking oil pump need not be flushed. These are to be cleaned after flushing.
- h) Gear boxes are not to be flushed, temporary pipe of 1 1/2" may be connected from inlet to drain through inspection window.

GOVERNING OIL CIRCUITS:

- a) All the orifices in trip oil, secondary oil and primary oil circuits are to be removed.
- b) Damaging devices in secondary oil circuits and primary oil circuits are to be removed.
- c) Control slide is to be taken out from the governing valve servomotors.
- d) Solenoid valve is to be kept in operating position.
- e) Tripping device is to be turned in to operating position locked.
- f) Starting device is to be turned into operating position and locked.
- g) About 20 to 30 mm dia temporary orifice is to be provided in the power oil inlet line to servomotors.
- h) Low lube oil protection is to be ensured for operating position by assembling 13mm thick stopper below the position.

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- i) Vacuum protection is to be kept in operating position with the help of lever.
- j) Position is to be removed from emergency stop valve or the

4.FLUSHING OPERATION:

Oil pump is to be switched on . In case of centrifugal pump delivery line is to be closed before switching on the pump and to be gradually opened later. Pump input amperage is to be watched and if it rises too high, pump delivery is to be throttled for reducing it. In case of positive displacement Pumps, all the valves in the delivery are to be kept fully open before switching on the pump. Any leakages found in the oil system are to be curbed.

Flushing is to be started with lube oil header to drain by blocking oil entry to bearings and providing a temporary line between the two headers.

Subsequently the flushing can be extended to individual bearing oil lines, governing system, to all oil pumps, standby coolers, standby filters and over head oil tanks etc.

The best cleaning effect can be obtained by using alternatively hot and cold oil for flushing. Oil should therefore be heater up to 70C to 80 C. Oil temperature should not go up beyond 85 C because higher temperatures may be harmful for the oil.

After flushing for a period of about four hours, at a temperature of 70 deg. To 80deg. Cent., oil is to be allowed to cool down to about 30 to 35 deg. cent. When the pipes also were cooled to that temperature, oil is to be again heated to 70 to 80 deg. Cent. All the pipes must be hot during oil flushing. If any pipes are found to be cold, the reason why oil is not flowing through those lines is to be investigated and the fault to be rectified. Tapping on the pipes at intervals, further improves the removal of foreign materials from the pipe walls.

5. FLUSHING PERIOD:

Coarse impurities will be retained by the strainer in the oil tank. For filtering out the smaller foreign particles, filter cartridges should be kept in position during the last third of the flushing time. Differential pressure across the filter should be watched and paper filter cartridges are to be replaced whenever the differential pressure rises above 1.5 Kg/mm.

Oil centrifuging equipment (if available) in to be kept in service during oil flushing as an additional means of purification . Other oil filtering facilities can be provided by inserting fine filter meshes (approximately 25 microns) at the flange connections of bearing housings. These meshes will enable to check the impurities still present after flushing.

Flushing operation has to be continued until no substantial amounts of contaminants are found in the filters any more or no substantial rise in differential pressure across filters with in a period of 12 hours.

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(Site Erection Notes)

POST FLUSHING OPERATIONS:

- a) Oil tank and strainers are to be cleaned. The oil tank is to be filled up with operating oil to the required level.
- b) Oil filter is to be cleaned . In c are f paper cartridges, used cartridges are to be replaced by new cartridges.
- c) If stop valve is included in the flushing, oil portion is to be cleaned and piston is to be assembled back.
- d) Lower half cells of bearing halves are to be cleaned. Thrust bearing pads and top halves of radial bearings are to be assembled in operating position.
- e) Removed orifices and damping devices are to be assembled back in trip, secondary and primary oil lines.
- f) Primary and secondary oil pipes are to be separately cleaned.
- g) Orifice at the power oil inlet to servomotor is to be removed.
- h) Stopper piece in low lube oil protection is to be removed and cleaned.
- i) Overhauling and assembly of control slide in servomotor is to be carried out.
- j) Temporary lines provided for flushing operation are to be removed.



AMENDMENT - NOTIFICATION

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WELDING ENDS

Under clause 1.4, read 'ANSI B16.25

as ANSI B16.25-1986

| | | | | | |
|------|----------------|------------------------|-----------------------|-------------------|---------------------|
| REF: | AMD. NO. 01 | APPROVED: AGM(E&CC) | ISSUED: SR.M(STDS) | DATE: JULY, 93 | CUM.SR. NO. 0035 |
|------|----------------|------------------------|-----------------------|-------------------|---------------------|



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WELDING ENDS

1. SCOPE

- 1.1 This standard covers the preparation of butt welding ends of pipes, welding neck flanges and pipe fittings but is equally applicable to other piping components which are connected into the piping system by butt welding.
- 1.2 Materials of piping components for which these welding ends are primarily intended are carbon and alloy steels. They may also be used for non-ferrous materials, upon satisfactory qualification of the welding procedures for the particular material.
- 1.3 This standard covers welding and preparation for one general type of joint only, i.e. without backing ring but does not prescribe specific types of welding processes and procedures. The other 3 general types of joints are (i) with split or noncontinuous backing ring (ii) with solid or continuous backing ring (iii) with consumable insert ring.
- 1.4 This standard is based on ANSI:B16.25

2: WELDING BEVEL DESIGN

- 2.1 Components having nominal wall thicknesses of 3 mm and less may have ends cut square or slightly chamfered ends (see Table 1, type I).
- 2.2 Components having nominal wall thicknesses over 3 mm to 22 mm inclusive shall have single angle bevels (See Table 1, type II).
- 2.3 Components having nominal wall thicknesses greater than 22 mm shall have compound angle bevels (See table 1, type III).
- 2.4 Dimensions of welding ends are given in table 2.

3. TOLERANCES

- 3.1 Dimensions A, B and t
 - 3.1.1 All components other than pipes: As specified in applicable ANSI/Corporate/Product Standard for the particular component.
 - 3.1.2 Pipes: As specified in plant standards HY 104 10 55, HY 106 10 32, HY 106 10 30.

Revision :

Issued **STANDARDS SECTION**
TECHNICAL SERVICES DIVISION

Date :

Prepared :

MAR
PDP

Approved :

Harish k khanijo
Sr. M (Stds.)

Date :

DECEMBER, 83.

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WELDING DETAILS FOR PIPES AND PIPING COMPONENTS

TABLE-1

12.5 ✓

| TYPE | WELD END THICKNESS-t (mm) | WELDING END DETAIL FOR JOINT WITHOUT BACKING RING | GAP BETWEEN TWO COMPONENTS TO BE BUTT WELDED |
|------|---------------------------|---|--|
| | WELD SYMBOL | | |
| I | $t \leq 3$ | | |
| | | | |
| II | $22 \geq t > 3$ | | |
| | | | |
| III | $t > 22$ | | |
| | | | |

NOTE:

- INTERNAL SURFACE MAY BE CHAMFERED FOR MAINTAINING DIMENSION ϕB AT THE WELD END, IF REQUIRED.
- INTER SECTIONS SHOULD BE SLIGHTLY ROUNDED.
- REPRESENTATION OF SHOP/SITE WELDS ON DRAWINGS SHALL BE AS MENTIONED BELOW.

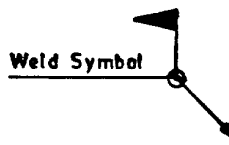
AT SHOP

Weld Symbol



AT SITE

Weld Symbol



- THE WELDING SYMBOLS GIVEN ABOVE ARE AS PER ISO:2553 EXCEPT THAT GIVEN FOR TYPE III.

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TABLE-2 DIMENSIONS OF WELDING ENDS

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

| OD x t | NOM. DIA. In | SCH. NO. | OD AT WELDING END Ø A | Ø B | t |
|--------------|--------------|----------|-----------------------|-------|-------|
| 21.3 X 3.73 | 1/2 | 80 | 21.3 | 13.84 | 3.73 |
| 21.3 X 4.78 | 1/2 | 160 | 21.3 | 11.74 | 4.78 |
| 21.3 X 7.47 | 1/2 | XXS | 21.3 | 6.36 | 7.47 |
| 25.0 X 3.6 | - | - | 25.0 | 17.8 | 3.6 |
| 25.0 X 5.0 | - | - | 25.0 | 15.0 | 5.0 |
| 26.7 X 3.91 | 3/4 | 80 | 26.7 | 18.88 | 3.91 |
| 26.7 X 5.56 | 3/4 | 160 | 26.7 | 15.58 | 5.56 |
| 26.7 X 7.82 | 3/4 | XXS | 26.7 | 11.06 | 7.82 |
| 33.4 X 3.38 | 1 | 40 | 33.4 | 26.64 | 3.38 |
| 33.4 X 4.55 | 1 | 80 | 33.4 | 24.3 | 4.55 |
| 33.4 X 6.35 | 1 | 160 | 33.4 | 20.7 | 6.35 |
| 33.4 X 9.09 | 1 | XXS | 33.4 | 15.22 | 9.09 |
| 48.3 X 3.68 | 1 1/2 | 40 | 48.3 | 40.94 | 3.68 |
| 48.3 X 5.08 | 1 1/2 | 80 | 48.3 | 38.14 | 5.08 |
| 48.3 X 7.14 | 1 1/2 | 160 | 48.3 | 34.02 | 7.14 |
| 48.3 X 10.15 | 1 1/2 | XXS | 48.3 | 28.0 | 10.15 |
| 60.3 X 3.91 | 2 | 40 | 60.3 | 52.48 | 3.91 |
| 60.3 X 5.54 | 2 | 80 | 60.3 | 49.22 | 5.54 |
| 60.3 X 8.74 | 2 | 160 | 60.3 | 42.82 | 8.74 |
| 60.3 X 11.07 | 2 | XXS | 60.3 | 38.16 | 11.07 |
| 60.3 X 12.5 | 2 | - | 60.3 | 35.3 | 12.5 |
| 73.0 X 5.16 | 2 1/2 | 40 | 73.0 | 62.68 | 5.16 |
| 73.0 X 7.01 | 2 1/2 | 80 | 73.0 | 58.98 | 7.01 |
| 73.0 X 9.53 | 2 1/2 | 160 | 73.0 | 53.94 | 9.53 |
| 73.0 X 14.02 | 2 1/2 | XXS | 73.0 | 44.96 | 14.02 |
| 76.1 X 3.2 | - | - | 76.1 | 69.7 | 3.2 |
| 76.1 X 4.0 | - | - | 76.1 | 68.1 | 4.0 |
| 76.1 X 5.0 | - | - | 76.1 | 66.1 | 5.0 |

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| OD x t | NOM. DIA. In | SCH. NO. | OD AT WELDING END ϕ A | ϕ B | t |
|---------------|--------------|----------|----------------------------|----------|-------|
| 76.1 X 10.0 | - | - | 76.1 | 56.1 | 10.0 |
| 76.1 X 12.5 | - | - | 76.1 | 51.1 | 12.5 |
| 88.9 X 4.0 | 3 | - | 88.9 | 80.9 | 4.0 |
| 88.9 X 5.49 | 3 | 40 | 88.9 | 77.92 | 5.49 |
| 88.9 X 7.62 | 3 | 80 | 88.9 | 73.66 | 7.62 |
| 88.9 X 11.13 | 3 | 160 | 88.9 | 66.64 | 11.13 |
| 88.9 X 15.24 | 3 | XXS | 88.9 | 58.42 | 15.24 |
| 108.0 X 16.0 | - | - | 108.0 | 76.0 | 16.0 |
| 108.0 X 20.0 | - | - | 108.0 | 68.0 | 20.0 |
| 114.3 X 4.5 | 4 | - | 114.3 | 105.3 | 4.5 |
| 114.3 X 6.02 | 4 | 40 | 114.3 | 102.26 | 6.02 |
| 114.3 X 8.56 | 4 | 80 | 114.3 | 97.18 | 8.56 |
| 114.3 X 11.13 | 4 | 120 | 114.3 | 92.04 | 11.13 |
| 114.3 X 13.49 | 4 | 160 | 114.3 | 87.32 | 13.49 |
| 114.3 X 17.10 | 4 | XXS | 114.3 | 80.1 | 17.10 |
| 114.3 X 32.0 | 4 | - | 114.3 | 50.3 | 32.0 |
| 114.3 X 40.0 | 4 | - | 114.3 | 34.3 | 40.0 |
| 139.7 X 5.0 | - | - | 139.7 | 129.7 | 5.0 |
| 139.7 X 10.0 | - | - | 139.7 | 119.7 | 10.0 |
| 139.7 X 16.0 | - | - | 139.7 | 107.7 | 16.0 |
| 139.7 X 22.2 | - | - | 139.7 | 95.3 | 22.2 |
| 139.7 X 25.0 | - | - | 139.7 | 89.7 | 25.0 |
| 152.4 X 17.5 | - | - | 152.4 | 117.4 | 17.5 |
| 159.0 X 30.0 | - | - | 159.0 | 99.0 | 30.0 |
| 168.3 X 4.5 | 6 | - | 168.3 | 159.3 | 4.5 |
| 168.3 X 7.11 | 6 | 40 | 168.3 | 154.08 | 7.11 |
| 168.3 X 10.97 | 6 | 80 | 168.3 | 146.36 | 10.97 |
| 168.3 X 14.3 | 6 | 120 | 168.3 | 139.7 | 14.3 |
| 168.3 X 18.3 | 6 | 160 | 168.3 | 131.7 | 18.3 |
| 168.3 X 21.95 | 6 | XXS | 168.3 | 124.4 | 21.95 |



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| OD x t | NOM. DIA. In | SCH. NO. | OD AT WELDING END ϕ A | ϕ B | t |
|---------------|--------------|----------|----------------------------|----------|-------|
| 193.7 X 32.0 | - | - | 193.7 | 129.7 | 32.0 |
| 219.1 X 6.35 | 8 | 20 | 219.1 | 206.4 | 6.35 |
| 219.1 X 7.04 | 8 | 30 | 219.1 | 205.02 | 7.04 |
| 219.1 X 8.18 | 8 | 40 | 219.1 | 202.74 | 8.18 |
| 219.1 X 10.31 | 8 | 60 | 219.1 | 198.48 | 10.31 |
| 219.1 X 12.7 | 8 | 80 | 219.1 | 193.7 | 12.7 |
| 219.1 X 18.3 | 8 | 120 | 219.1 | 182.5 | 18.3 |
| 219.1 X 27.1 | 8 | - | 219.1 | 164.9 | 27.1 |
| 219.1 X 32.0 | 8 | - | 219.1 | 155.1 | 32.0 |
| 219.1 X 36.0 | 8 | - | 219.1 | 147.1 | 36.0 |
| 244.5 X 32.0 | - | - | 244.5 | 180.5 | 32.0 |
| 273.0 X 6.35 | 10 | 20 | 273.0 | 260.3 | 6.35 |
| 273.0 X 7.8 | 10 | 30 | 273.0 | 257.4 | 7.8 |
| 273.0 X 9.27 | 10 | 40 | 273.0 | 254.46 | 9.27 |
| 273.0 X 12.7 | 10 | 60 | 273.0 | 247.6 | 12.7 |
| 273.0 X 15.1 | 10 | 80 | 273.0 | 242.8 | 15.1 |
| 273.0 X 21.4 | 10 | 120 | 273.0 | 230.2 | 21.4 |
| 273.0 X 28.58 | 10 | 160 | 273.0 | 215.84 | 28.58 |
| 273.0 X 33.5 | 10 | - | 273.0 | 206.0 | 33.5 |
| 273.0 X 45.0 | 10 | - | 273.0 | 183.0 | 45.0 |
| 273.0 X 50.0 | 10 | - | 273.0 | 173.0 | 50.0 |
| 323.9 X 6.35 | 12 | 20 | 323.9 | 311.2 | 6.35 |
| 323.9 X 8.38 | 12 | 30 | 323.9 | 307.14 | 8.38 |
| 323.9 X 10.31 | 12 | 40 | 323.9 | 303.28 | 10.31 |
| 323.9 X 12.7 | 12 | XS | 323.9 | 298.5 | 12.7 |
| 323.9 X 17.48 | 12 | 80 | 323.9 | 288.94 | 17.48 |
| 323.9 X 28.0 | 12 | - | 323.9 | 267.9 | 28.0 |
| 323.9 X 28.58 | 12 | 140 | 323.9 | 266.74 | 28.58 |
| 355.6 X 9.53 | 14 | 30 | 355.6 | 336.54 | 9.53 |
| 355.6 X 15.09 | 14 | 60 | 355.6 | 325.42 | 15.09 |

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| OD x t | NOM. DIA. In | SCH. NO. | OD AT WELDING END ϕ A | ϕ B | t |
|---------------|--------------|----------|----------------------------|----------|-------|
| 355.6 X 12.7 | 14 | XS | 355.6 | 330.2 | 12.7 |
| 355.6 X 19.05 | 14 | 80 | 355.6 | 317.5 | 19.05 |
| 377.0 X 9.0 | - | - | 377.0 | 359.0 | 9.0 |
| 406.4 X 7.5 | 16 | - | 406.4 | 391.4 | 7.5 |
| 406.4 X 9.53 | 16 | 30 | 406.4 | 387.34 | 9.53 |
| 406.4 X 12.7 | 16 | 40 | 406.4 | 381.0 | 12.7 |
| 406.4 X 16.0 | 16 | - | 406.4 | 374.4 | 16.0 |
| 406.4 X 21.4 | 16 | 80 | 406.4 | 363.6 | 21.4 |
| 406.4 X 22.23 | 16 | - | 406.4 | 361.94 | 22.23 |
| 406.4 X 25.0 | 16 | - | 406.4 | 356.4 | 25.0 |
| 457.0 X 12.7 | 18 | XS | 457.0 | 431.6 | 12.7 |
| 457.0 X 14.27 | 18 | 40 | 457.0 | 428.46 | 14.27 |
| 457.0 X 23.8 | 18 | 80 | 457.0 | 409.4 | 23.8 |
| 457.2 X 25.0 | 18 | - | 457.2 | 407.2 | 25.0 |
| 457.2 X 32.0 | 18 | - | 457.2 | 393.2 | 32.0 |
| 508.0 X 12.7 | 20 | 30 | 508.0 | 482.6 | 12.7 |
| 508.0 X 15.11 | 20 | 40 | 508.0 | 477.78 | 15.11 |
| 508.0 X 28.0 | 20 | - | 508.0 | 452.0 | 28.0 |
| 508.0 X 45.0 | 20 | - | 508.0 | 418.0 | 45.0 |
| 559.0 X 22.2 | 22 | 60 | 559.0 | 514.6 | 22.2 |
| 559.0 X 32.0 | 22 | - | 559.0 | 495.0 | 32.0 |
| 610.0 X 12.7 | 24 | XS | 610.0 | 584.6 | 12.7 |
| 610.0 X 20.0 | 24 | - | 610.0 | 570.0 | 20.0 |

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GENERAL SPECIFICATION PIPING INSULATION

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1.0 INTENT OF SPECIFICATION

This specification is intended to cover design, manufacture, fabrication, testing at manufacturer's shop, complete supply including all accessories and jacketing, delivery F.O.R. site duly packed for transportation of hot thermal insulation for piping, valves, fittings & specialities as specified in insulation data sheet and insulation schedule documents and as required.

Application of insulation will be in the scope of erection contractor(outside purview of this specification).

2.0 GENERAL INFORMATION

2.1 The thermal insulation shall be applied on the outer surface of piping, valves, fittings, equipment etc., to conserve the heat energy and also to maintain the outside surface temperature of the insulation below or at 60⁰ C for the safety of operating personnel.

2.2 Insulation thickness shall be computed on the basis of the following data unless otherwise specified:

- a) Design ambient temperature : 45⁰ C.
- b) Outside surface temperature of insulation jacket : 60⁰ C
- c) Emissivity of Aluminium sheet : 0.11
- d) Thermal conductivity of insulating material at different temperatures shall be as stipulated in IS:8183 & IS:9842 as applicable.
- e) Wind velocity : 1 metre/sec.

2.3 Insulation shall be supplied in thicknesses of 25, 40, 50 and 75 mm and higher thickness shall be made up in multiple layers from them.

2.4 Minimum Recommended Insulation thickness have been shown in Insulation schedule. Bidder, however, shall check the adequacy of the specified thickness and confirm the same. In case the specified thickness is not available from the manufacturer's standard sections, nearest higher section shall be selected where available, or thickness may be built up in layers over the section with the nearest thickness as has been specified. Wherever insulation thickness have not been indicated. Same is to be furnished by the Bidder indicating the corresponding type, class/density, thickness, design values of

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GENERAL SPECIFICATION PIPING INSULATION

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conductivity of thermal insulation, and other design data considered (for items listed under 2.2 above).

- 2.5 All covering necessary to protect insulation from the weather shall be supplied. Also all temporary covering as required during application of insulation to protect the environment/surrounding from insulating materials shall have to be provided.

3.0 CODES AND STANDARDS

All item and work covered under this specification shall conform to the latest edition of the following codes and standards :-

- IS : 280 : Mild Steel Wire for general engineering purpose.
IS : 737 : Wrought aluminum and aluminum alloys, sheet and strip.
IS : 3144 : Methods of test for mineral wool thermal insulation materials.
IS : 3346 : Methods of determination of thermal conductivity of thermal insulating materials.
IS : 7413 : Codes of practice for application and finishing of thermal insulating materials at temperatures between 40⁰ C & 700⁰ C.
IS : 8183 : Specification for bonded mineral wool.
IS : 9842 : Specification for preformed fibrous pipe insulation.

4.0 SCOPE OF WORK

4.1 Scope of Supply

Required amount of insulating material and all other materials e.g. binding wires, stitching wires, coversheets/jacketing, expansion joints, bonding compound, adhesives, insulation supports, fastening materials, bands etc. as specified and as required for all items to be insulated as per Specification.

5.0 MATERIALS TO BE USED

- 5.1 The insulation material to be supplied under this Specification shall be of preformed bonded mineral wool sections as per IS:9842 or bonded mineral wool mat as per IS:8183

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GENERAL SPECIFICATION PIPING INSULATION

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or approved equivalent, to meet the conductivity values as furnished for group 4 density class of the said Indian Standards.

- 5.2 The insulation shall be of preformed bonded mineral wool sections of 150 Kg./Cu.m density as per IS:9842/approved equivalent.
- 5.3 Wherever, preformed bonded mineral wool sections can not be used, factory finished, machine made, machine stitched bonded mineral wool mat of 150 Kg./Cu.m density as per IS:8183 approved equivalent shall be provided.
- 5.4 Insulating material shall be suitable for the temperature of the pipe / equipment. For bonded mineral wool insulation, the bonding substance shall retain its property upto 600 °C.
- 5.5 The insulating material whether dry or wet shall be non-corrosive and shall be incombustible as per relevant standard and free from asbestos.
- 5.6 Depending upon the application procedure, loose insulating materials as per IS:3677 if unavoidable, may be used (partly) on such items as valves etc., subject to Purchaser's approval.
- 5.7 Preformed sections shall be secured by means of aluminium bands of 20 mm x 22 SWG (as per IS-737 or equivalent) atleast at every 500 mm spacing.
- The bonded mineral wool shall be secured by means of galvanized steel wire (as per IS:280 or equivalent) of at least 0.7 mm dia in the form of hexagonal netting of 10 mm to 13 mm aperture.
- 5.8 Binding wire to be used for the application of the insulation shall be galvanized steel wire conforming to IS:280 (latest revision) and of thickness 1.0 to 1.6 mm. For above 400⁰ C, binding wire shall be of S.S of suitable grade.
- 5.9 The stitching wire shall be 0.7 mm diameter copper wire conforming to IS:4412 (latest revision). For above 400⁰ C., stitching wire shall be of S.S. of suitable grade.
- 5.10 Jacketing Material (Cladding)

The metallic jacket over the insulation shall be of Aluminium sheet conforming to IS:737 (latest revision) and thickness not less than 20 SWG., except for small bore piping (pipes less than 80 NB) where 22 SWG. May be used subject to purchaser's approval.

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GENERAL SPECIFICATION PIPING INSULATION

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5.11 All other materials, e.g., insulation supports, expansion joints, washers, etc. shall be of standard design.

6.0 THERMAL INSULATION APPLICATION PROCEDURE

Bidder shall furnish the insulation application procedure for carrying out application At site by erection contractor. All materials as required for application of application shall be in the scope of vendor.

7.0 INSPECTION & TESTING

7.1 The Contractor shall furnish test certificates from any one of the independent authorities listed below or any other reputed body subject to Purchaser'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, UP.

7.2 The Bidder shall carry out all the tests according to IS:8183/3144 or according to any internationally accepted standard. The tests shall be done on representative samples drawn from the insulating material supplied under this specification. Thermal conductivity tests for the offered insulating material at various mean temperatures and tests to ensure bonding property of bonded mineral wool (if offered) upto 600 Deg.C shall be conducted in presence of Purchaser's representative.

7.3 All the tests mentioned in IS:3144 shall be carried out for establishing various chemical and physical properties in accordance with the procedure laid down therein.

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

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- a) Thermal conductivity, in mW/cm Deg. C., of the offered insulating material at various mean temperatures.
- b) Bonding property of bonded mineral wool insulation (if offered) upto 600 Deg. C.
- c) A complete chemical analysis report indicating the composition of insulation.
- d) All other tests as per IS:3144.

8.0 PERFORMANCE GUARANTEE

The bidder shall have to meet the specified surface temperature and the conductivity values of the thermal insulation shall not be more than that specified for group 4 of IS 9842 and IS 8183.

9.0 DRAWINGS, DATA AND INFORMATION REQUIRED

- 9.1 The Bidder shall enclose with his offer the following drawings and information as minimum requirement.
 - 9.1.1 A schedule indicating various types of insulation to be furnished, material specification, code and insulation thickness for each equipment, vessel and piping covered under this specification.
 - 9.1.2 Drawings and write up illustrating the application procedure for the insulation materials offered.
 - 9.1.3 Test Certificates for all the tests as applicable for each type of insulating material offered.
 - 9.1.4 A comprehensive experience list giving the name of the projects, customers, order valves, year of execution etc.
- 9.2 The Bidder shall furnish the following data and information after award of contract.
 - 9.2.1 Final versions of all drawings and data as detailed in clause No. 9.1
 - 9.2.2 Application procedure along with write-up and drawings.
 - 9.2.3 All test certificates of insulating materials.

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HYDERABAD

PRODUCT STANDARD TURBINES & COMPRESSORS

TC – 9 – 1900

REV NO: 02

SHEET 1 OF 3

TECHNICAL SPECIFICATION FOR NON SHRINK FREE FLOW GROUT MIX

1. **SCOPE:** This specification is valid for Non-shrink free flow grout mix to be cast below the base-plates, bedplates and bearing-housings/pedestals for supporting the turbine generator sets. This specification applies for manufacture, working (processing) and quality control of non-shrink free-flow grout mix of cement base.
2. **GUIDELINES:** The latest version of the following standards may be referred.
 - DIN 1164:
 - DIN 18555: Mortar from mineral binding agent. (Testing)
 - DIN 50014: Climate and its technical application.
 - DIN 1048: Testing Methods for concrete.
 - DIN 50100: Material testing – Fatigue testing.
3. **REQUIREMENTS OF NON-SHRINK FREE-FLOW GROUT MIX:**
 - 3.1 The non-shrink free-flow grout mix must be made from cement base and shall be a permanently controlled and unchanging compound, to which only water shall be added at site before use.
 - 3.2 A good flowing capability of non-shrink free-flow grout mix must be demonstrated to BHEL through a trail pouring with a large base plate. In this pouring, the grout mix is filled in from one side, flows gradually below the base plate and equalizing itself fills all the hollow pockets. The base plate is taken out after 24 hours and the surface is inspected and judged.
The casting-in of base plates/bed plates with non-shrink free-flow grout mix is made for improvisation of supporting techniques. By this process, a uniform transmission of the mass forces and vibrations of turbo generator to the foundation is achieved.
Usually the cast height measures 50mm with a tolerance of ± 20 mm.
 - 3.3 The non-shrinking property of the grout mix shall be guaranteed. The expansion shall be proportional with in the stabilizing period of approximately 24 hours in order to guarantee a force transmission between foundation and the machine. After 24 hours no more expansion shall take place.
 - 3.4 The non-shrink free-flow grout mix shall have the following properties.
 - Chloride free
 - Non metallic
 - Non corrosive
 - Oil and water resistant
 - Resistance for moisture & Temperature variations.
 - High bonding strength.
 - 3.5 Properties after casting.
 - a) Compressive strength: Minimum 35 N/mm² - after 24 hours
Minimum 60 N/mm² final strength - after 28 days
 - b) Expansion coefficient:
The expansion coefficient of the cast mass shall be same as that of the foundation.
 - c) Impact and Vibration:
Should possess resistance to impact & should withstand vibration with out fracture.
4. **SUPPLIERS AND TYPE OF SUPPLY:**

This is to be purchased only from reputed manufacturers of non-shrink free-flow grout mix. They have to get all the tests done, enumerated below, at a national material-testing laboratory and furnish all the test certificates, which are subject to the acceptance by the design department.

The shrink-free pouring grout is to be packed in packets in the weight range of 25 to 50 kg and supplied. The packing shall be so made that the shrink free pouring grout is well protected from moisture and dirt. The packing must be stamped with date of manufacturing and expiry. Each consignment of shrink-free pouring grout mix must be accompanied by detailed, valid processing (working) instructions (leaflet).

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| Prepared B.N.Patel | Checked G.P. Rao | Approved G.P. Rao | Date 19.06.1988 |
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5. TESTS OF NON-SHRINK FREE-FLOW GROUT MIX:

(AT NATIONAL MATERIAL TESTING LABORATORY)

- 5.1 Determination of spreading (Slumping dimension) as per DIN 18555, in relation to compound (mixing) ratio of dry non shrink grout: water.
- 5.2 Determination of workability after 10, 20, 30, 50, 70, 90 and 110 minutes at a temperature of 5°C and 20°C.
- 5.3 Determination of beginning and end of solidification.
- 5.4 Determination of bending and compressive strength in accordance with DIN 1164. The tests are to be carried out on test grout mix prism of 4cm x 4cm x 16cm after 8 hours, 1 day, 3 days, 7days, and 28days. The preparation and testing of test pieces is to be done at controlled temperature of 5°C and 20°C.
- 5.5 Determination of change in volume of non-shrink free-flow grout after 1 day, 3 days, 7days, and 28days. Pouring grout mix is to be mixed with a water/powder ratio of 1:5.55 i.e., 0.180, and to be poured into commercial size 1 kg container (Ø 99 mm height 120mm) up to 20mm under the lip. The container is to be set up with a rubber lining and to be covered with a weight 250g until compact. This is to be kept at 5°C and ambient temperatures and tested after 24 hours, 3days, 7days and 28 days for change in volume. The water contact at the top of the grout is to be measured with the aid of a volumetric measuring method (refer simplified measuring method to measure the change in volume of a compressed mortar, by Hermann Schmid, in concrete or steel concrete buildings 54th volume, book7, July 1959 Ed. Page 177). The results are to be tabulated.
- 5.6 Experiments on compression – Swelling zones on non-shrinking pouring grout. Mortar prisms of 4cm x 4cm x 6.5cm of 28 days or more old (Compression face 4x6.5cm²).
- a) Determination of test sample height in the loading direction and determination of consequent upset under a load of 20.4 N/mm². The shape changes are measured with strain gauges, which are mounted respectively on two opposite faces of the test specimen.
- b) Carrying out fatigue tests in accordance with DIN 50100 under the following conditions:
- Loading (Stresses) in the compression: Swelling zones.
 - Under stress : $\sigma_4 = 0.981 \text{ N/mm}^2$
 - Fluctuation of stress : $2 \sigma_A = 20.4 \text{ N/mm}^2$
 - Loading cycle frequency : n 30 Hz.
 - Limiting number of load cycles: 10^7
- c) Determination of test specimen's upset, when the test piece has not failed till the limiting number of loading cycles during the fatigue test.
- d) Determination of compression strength of loaded test specimens and comparison with compression strength of test specimen, which is not loaded.

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