Technical Specifications and Scope of work

Special Note –

This work for General Repair Works in Boiler Axillaries at CPP involves extensive rigging, fitting, cutting & welding work. Contractor shall visit the site and estimate the quantum of work before submission of bid. Quantities given in the schedule are based on approximations & assumptions. Therefore, contractor shall carry out his own assessment before bid submission. Actual execution of the item wise quantities may vary depending upon the shape & size of the different nature of job available with the department. No minimum quantity of the job will be assured for any item of Schedule of quantity.

Prerequisites of the work:

A. Normal working hours for the works shall be from 0900 Hrs to 1700 Hrs on working days only.Contractor shall submit his quotation by considering all kind of emergency work. He may be call at any point of time as per requirement of plant.

B. No work shall be carried out with-out a valid safety work permit and without availing the permission of the EIC.

C. Use of personal protective equipment (PPEs) like: Helmet with chin strap, Safety goggles, Cutting glasses, Welding face Shield, Asbestos Gloves, Safety Shoes with metallic toe guard, safety belt & full body harness for jobs at high elevation/ on scaffolding etc, Dust Mask or any other PPEs as per the requirement of the job are compulsory.For executing all the works, General safety guide must be followed scrupulously by the contractor and his laborers. If any contract worker is found working in place without wearing safety helmet or safety shoes or safety rope in case of height job,deemed to fit action will be taken against contractor as per department's decision. Any lapse in following general safety guide will be viewed seriously and it may attract the suspension of work and termination of the contract

   Note – Dust Mask, Helmet with chin strap & safety shoes with metallic toe guard are primary PPEs required for work, no contract worker shall enter the work site without the above three PPEs as listed above. In an event of violation, strict action will be initiated against the contractor.

D. Gas regulators / cutting torches / welding torches with back fire preventing feature shall only be used.

E. Work involves cutting of stainless-steel plates in significant quantities therefore contractor must have air plasma cutting machine for cutting stainless steel / steel smoothly in minimum time. Cutting of stainless-steel plates using cutting electrode will not be permitted. Alternatively cutting wheels can be used for cutting where straight profile is required but with wheel guards and face/ body shields as protective equipment.

   In case contractor found cutting the plates with arc of cutting electrode, department reserves the right to stop the work & suitable action will be initiated against the contractor.

F. Welding Machines, Grinding Machines, cutting machines shall be equipped with ELCBs for electrical safety of working personnel. In case contractor found use of machines without ELCBs penalty shall be imposed equivalent to the cost of ELCBs as prevailing market rate.

G. Welding machine cables must not have any un-insulated joint / damaged portion.

H. Drawing of spares / consumables from the stores to work area and shifting of old spares / scrap to the stores / scrap yard / maintenance area / any designated place are under the contractor's scope.

I. Account of the workers working in the system for the above work must be maintained by the contractor on daily basis and the same shall be submitted to the EIC on daily basis.

J. Running bill of the work will be prepared once in every three months on contractor's request. Contractor must have signed the logbook before taking the job as a token of assigning of job to him. This signed logbook is required at the time of bill preparation.

K. Rigging equipment like – Chain pulley blocks, Slings, D-Shackles, Electrical Hoist etc. are under the contractor scope only. If required, the contractor shall carry out the load test of his rigging equipment on demand by the department to demonstrate the healthiness of his equipment before use.

L. Material Handling Equipment (MHEs) like Forklift/ Hydra will be arranged by the department. In case MHEs are not available in the department at the time execution of work contractor shall arrange on his own, no separate payment willgivenfor arranging these MHEs.

M. All kinds of welding electrodes unless specified in the scope of work in specific Item No. are under the scope of contractor. Use of electrodes of standard make like: L&T, D&H, Ador-fontech and ESAB make shall only be used. Before starting of welding,Quality of electrodes must get approved by EIC before use. In case contractor not taken approval and executed the welding, all welding shall be cut as advised by department and execute the welding after getting approval.

N. In case of any dispute, decision of EIC will be considered as final.

O. Contractor must submit the qualification details of each worker including welder, rigger and his specialization with relevant documents as proof of the same before start of the work.

P. All kinds of tools & tackles required for the work are in the contractor's scope of supply.

Q. Material required for fabrication of new inlet chute (SS 410 plates) will be provided by the department for use under department custody and will not be issued as free issue material to the contractor.

R. One contract supervisor (skilled in fabrication & rigging jobs) shall essentially report to the EIC of this work / department representative for daily co-ordination / progress of the job / Planning of jobs / coordination for issue / renewal / surrender of safety work permit etc.

S. Contract supervisor must be literate / must have sufficient technical experience in fabrication, erection & rigging jobs. Item wise scope of the work is given for ease of understanding the work;however,contractor must visit HWPM site for understanding the design of existing inlet chutes and understanding the scope of the work.

T. Assistance for drawing the required material from stores shall be provided by the contractor. Scrap generated during the work, shall be collected from the site and shiftedto designated place by the contractor. No work item / part will be considered as complete unless the scrap generated is collected and disposed at designated place.

All the above prerequisites shall be followed strictly by the contractor. In case any prerequisite is violated, suitable action will be initiated.

Item wise scope of the work is as follows:

Item no. 1) Erection and commissioning of mill chute and connecting pipes:

Dismantling and Assembly of inlet chute & coal inlet pipe from coal feeder & mill & shifting them to floor. Dismantling and Assembly of hot air jacket from inlet pipe:

Dismantling work:Scope includes marking of old inlet chute and taking measurements required for fabrication of new inlet chute, dismantling of the old damaged inlet chute and shifting the old damaged inlet chute and hot air jacket to the ground / feeder floor as per the requirement. All the works like dismantling of the fasteners, rigging, cutting, welding, grinding etc are in the contractor'sscope. Hot air jacket along with inlet pipe are also to be dismantled and to be shifted to ground for inspection by department staff for any damage.

Assembly work: Scope includes assembly of the newly fabricate inlet chute to the coal feeder & inlet pipe. Heating air jacket is to be fastened to the inlet pipe & hot air connections are to be normalized back. Alignment of the inlet chute with respect to the coal feeder & coal mill is to be carried out to maintain verticality of the inlet pipe & chute.

New gaskets & new coal inlet spools are to be used while assembly.

Valves for hot air jacket shall be checked for their freeness and are to be serviced for normalization of the system by contractor. Servicing of valves is included in the scope of this item.

Verticality of inlet chute & pipe to be maintained during fabrication and assembly and it is the contractor's responsibility to prove the true verticality of the inlet chute pipe to the department.

Leak test for hot air jacket using air at a pressure - 1.5 to 2 times the working pressure and soap solution with glycerin mixed in it, to be performed by the contractor and to be witnessed by the department. Supplier has to make all arrangements like extension of air line for leak test by cutting & welding, arrangement of soap solution with glycerin mixture, assembly of valve and hose is under scope of contract for which no extra cost will be given to contractor.

Item no. 2.) Handling of inlet chute:

Scope covers drawl of new SS plates-410 from the stores and cutting them in the required shapes & sizes for fabrication of new inlet chute. Bending required to be carried out after cutting the sheets. New inlet chute to be installed in place of damaged chute.

Final weight of the inlet chute made ready for installation will be measured for billing / measurements purpose.

Item no. 3.) Cutting and welding of flange/pipe chute:

Scope for this item covers cutting of circular flanges from old inlet chute & welding the same to the newly fabricated inlet chute. Cutting is to be carried out by air plasma cutting machine.

Cutting by welding electrode or any othermethod except air plasma shall not be accepted. Surface preparation is required to be carried out before welding of flanges to chute. Excess weld metal is to be removed by grinding the weld area to achieve smooth finish for smooth coal flow without sticking.

In case, more damage is observed in inlet pipe, old pipe is required to be replaced as per the decision of the EIC. Assistance for drawing of new SS pipe for replacement is under the contractor's scope for which no extra cost will be payable.

Dye penetrant testing of weld bead, after grinding will be carried out by the contractor & the same will be witnessed by department staff to ensure welding quality. Porosity if any is required to be repaired by metal deposit by welding & again the same is to be grinded to achieve smooth finish.Supply of Dye penetrant kit (cleaner, dye and developer) are under the contractor's scope. Contractor shall show the DPT kit to the EIC of work, before start of testing, EIC shall check the date of expiry of dye penetrant kit before use. Expired dye penetrant kit shall not be used in any circumstances. Dye penetrant testing shall be carried out in accordance with relevant code of practice.

Note: Compatible / suitable electrodes as prescribed by EIC of work are to be used for welding and are in the contractor's scope. Contractor shall get the approval from EIC before using the electrodes for welding.

Item no. 4.)Fabrication of chute by Welding

Welding of the stainless-steel plates (SS-410) is required to be carried out for fabrication of inlet chute. Surface preparation is to be carried out before welding as per the instructions from department representatives. Excess weld metal is to be removed by grinding the weld area to achieve smooth finish for smooth coal flow without sticking. Dye penetrant testing of weld bead after grinding will be carried out by the contractor & the same will be witnessed by department staff to ensure welding quality. Porosity if any is required to be repaired by metal deposit by welding & again the same to be grinded to arrive smooth finish. Welding repair of inlet pipe & heating air jacket, is required to be carried out by patch welding, in case it is found damaged.
Dye penetrant testing of weld bead after grinding will be carried out by the contractor & the same will be witnessed by department staff to ensure welding quality. Porosity if any is required is to be repaired by metal deposit by welding & again the same is to be grinded to achieve smooth finish. Dye penetrant kit (cleaner, dye and developer) are under the contractor's scope. Contractors shall check the date of expiry of dye penetrant kit before use. Expired dye penetrate kit shall not be used in any circumstances. Dye penetrate testing shall be carried out in accordance with relevant code of practice.

Note: Compatible / suitable electrodes as prescribed by EIC are to be used for welding and are in the contractor's scope. Contractor shall get the approval from EIC before using the electrodes for welding.

Welding is to be carried out on both sides of plate after surface preparation. Separate measurements will be taken for both sides

Item no.5.) Removal, trimming/grinding and fixing of ferrules in APH tubes.

Scope of this item covers

Removal of Ferrules:

i) Cleaning of Air pre-heater hot pass by removal of ash.
ii) Identification of APH tubes with damaged ferrules and marking for replacement.
iii) Preparation of drawing after identification of damaged ferrules and same shall be submitted to EIC for taking clearance for taking up replacement work.
iv) Damaged ferrules shall be removed from the APH tubes with any method suitable to contractor without damaging the shell plates and tubes of the APH. In case contractor does not have his own technique, ferrules can be removed by cutting the ferrules using gas cutting torch/ electrode cutting and a highly qualified welder / cutter. If any of the tube is having more than 3 ferrules,then all ferrules are to be removed from each tube. Removal of all old ferrules from one tube is considering one unit in measurement.Damaging the base plate and AHP tube during cutting is not permissible. In an event of damage of government property, amount will be deducted from final bill as per prevailing market rate.

Trimming/grinding

v) Hard deposit present between ferrules and APH tubes which are to be removed by grinding/reaming using portable machines. Internal diameter of the tubes is to be checked after removal of the hard deposits for checking the suitability of new ferrules. 100% hard deposit removal in the ferrules of APH are to be ensured.
vi) Before starting the job, a material scrap bin is to be arrange by contractor and generated metal scrap will be collected into the scrap bin and same is to be submitted to stores, HWPM.
vii) Measure the internal diameter of APH tubes, in which substitution of APH ferrules is to be carried out.
viii) Outer surface of new ferrules is to be adjusted by grinding/machining such that it can be inserted inside the APH tubes. Grinding wheel, ambry paper files and all tools and tackle required for surface preparation are under scope of contractor.
ix) If any kind of machining required for preparatory job shall be arranged by contractor and is covered under contractor scope of supply.

Fixing of ferrules in APH tubes

x) New ferrules shall be inserted into the tube.
xi) Care shall be taken to avoid movement of the contract manpower over the newly fixed ferrules.
xii) New ferrules shall be pushed inside the APH tube softly using wooden mallet up-to the required depth inside the APH tubes as directed by department representatives.
xiii) There shall be no gap between the tube and ferrule, in case there is any gap left, same to be filled and removed by the contractor as per the instructions of the department. Any gap left may lead to erosion of the APH tube, to ensure extended life of APH tubes.

Prerequisites of the ferrules work:

A. Contractor shall depute sufficient man-power in general shifts (0900 Hrs to 1700 Hrs) as timelycompletion of work is the essence of the contract. Work progress to be monitored on daily basis with report. In case the work lags behind the schedule, contractor may be asked to depute additional manpower in round the clock shifts.
B. No manpower shall be allowed to work for more than 8 Hrs / day in Confined Space entry environment. Ventilation fan shall be arranged by cutting the housing of APH as

directed by department representative. After completion of work ventilation fan shall be removed and casing to be normalized by welding by the contractor. Arrangement of ventilation fan, cable and ELCBs is under the scope of contractor. Electrical connections will be given by the department on contractor's request.

C. Contractor will be asked to carry out the work during annual overhauls of SGs and MTA common shutdown, contractor may be asked to carry out the work and depute the man-power accordingly in round-the-clock shifts.

D. Substitution of APH ferrules is planned in hot pass and cold pass. Skilled manpower capable of substituting at-least 100 ferrules per days shall be deputed by the contractor. A maximum of 20 days for substitution of ferrules in each SG will be given to the contractor for replacement of ferrules in each SG.

E. Contractor shall ensure the best quality of workmanship to avoid re-work. No extra measurements will be recorded for re-work and compensation for delay caused if any due to rework will be initiated against the contractor.

All the above prerequisites shall be followed strictly by the contractor. In case any prerequisite is violated, suitable action will be initiated.

Item No.6) Welding (Non-IBR):-

I. Contractor has to mobilize manpower& shift welding equipment to work spot.
II. Departmental staff will identify the job and job has to be carried out as per the guidelines of departmental staff.
III. Qualified welders only will be allowed to carryout the welding job (MS/CS/SS).
IV. The welding has to be carried out as per the procedure HWPM/WAS/01.
V. Welding of pipe of MS/SS/CS and coal pipe is cover under this scope.
VI. Measurement will be done in inch-dia.

Item No. 7) Linear welding (other than structural fabrication measured in MT):-

I. This specification covers linear welding on different structures of different sizes.
II. Contractor has to mobilize manpower &welding equipment to work spot.
III. Department staff will identify the job and as per the guidelines of department staff, job has to be carried out.
IV. The welding has to be carried out as per the specifications.
V. Any kind of patch work required during execution of work or as per plant operation same shall be cover under this scope. Patch preparation (i.e. cutting and welding of

patch of MS/SS material) is cover under this scope. Measurement of patch is taken into meter.

VI. Measurement will be done in meters.

VII. Contractor has to cut the structural material with gas cutting/grinding/electrode cutting (MS plate and SS plate) with suitable arrangement. All tools and tackle for cutting shall be under scope of contract. Cutting of scrap structural material is not cover in this item no.

Item No. 8) Pipe laying / handling:

I. All pipes and fitting required to execute the job shall be drawn from DPS/ local store and shifted to the job location.Required piping and pipe fittings are to be shifted to location manually or with the help of lifting tools & tackles.

II. Pipe lying is to be carried as per the guidelines of department.

III. All the pipes are to be supported as per the guidelines of department.

IV. All supports are to be fabricated and anchored to the structures suitably.

V. The sliding and anchoring supports will be decided by the department.

VI. Required arrangement has to be made for lying of pipes like platform and scaffolding etc which is under scope of contractor. There are no separate measurements of scaffolding. Erections of scaffolding rate are included in these items.

VII. The pipe has to be cut to required lengths by grinding or by gas cutting using oxy acetylene gas/ by cutting wheel.

VIII. Coal pipe laying is also included in this scope of work.

IX. Measurement will be done in inch - meter.

Item No. 9) Structural fabrication/ Repair:

I. Required size of scaffolding has to make/ erected before taking of job. There are no extra payment for scaffolding making and removal will be paid to contractor. Making and removal of scaffolding is under scope of contractor. Scaffolding shall be made as per point no (n) General points.

II. Required structural materials like angles, channels, plates, grills and beams etc., are to be drawn from stores and to be shifted to locations safely with suitable arrangement.

III. Required arrangement has to be made for erection of structures like plat-forms and scaffoldings etc., for which no extra payment will be given.

IV. All the structural material has to be cut to required sizes by gas cutting using oxy acetylene gas.

V. The size of weld bead will be as per the decision of the department. 2nd layer of weld bead is to be done if required without any extra cost.

VI. All structural members are to be aligned properly before welding.

VII. The required electrodes for this fabrication job is E 6013 preferably Advani make.

VIII. Fabrication of grill is cover under this scope. Contractor has to quote as per taking into consideration for fabrication of grill. The grill fabrication is measure in MT only.

IX. Measurement will be done in MT.

X. In case of work related to Air and flue gas ducts,scope is given below.

a. All the new plates required for the duct repair has to be drawn from the stores.
b. Required arrangements for drawl of material from stores/section are to be made by the contractor.
c. After drawl of material, it has to be stacked properly.
d. New plate thickness will be 5.0 mm to 8.0mm.
e. The required curvature of the bend has to be made as per the existing profile of the duct dimensions by suitable tools and tackle.
f. After bending of plates, they are to be cut with gas to a suitable size for replacement in locations.
g. The size of plates required to be cut will be as per the replacement requirement and it will be decided by department.
h. After cutting the plates, plates are to be shifted to different locations as required for replacement.
i. Proper pulleys / winches or chain pulley blocks are to be used for shifting the material.
j. Support clamps and anchors required for lifting and shifting to be arranged for safe working.
k. If any arrangement needed for safe working while carrying out the job it has to be arranged as per the instructions of department / safety section.
l. After lifting the plates to the locations, they are to be positioned and aligned properly.
m. All the edges of the new plates are to be ground and cleaned.
n. New plates are to be aligned and straightness to be maintained while fit up.
o. All the new plates are to be welded to the ducts with lap joint.
p. Each run of the weld bead has to be cleaned thoroughly.
q. AWS 6013 welding electrodes are to be used for carrying out the welding. The electrodes are to be used from standard make preferably Advani make. If any other standard electrodes are to be used it has to be approved by department.
r. There should not be any weld defects like, cracks, blow holes, undercut and lack of fusion.
s. If any defective welding is identified same has to be ground and re-welding to be done.

Item No. 10) Removal of old structural material and shifting to scrap yard:

I. Required arrangement like plat forms and scaffoldings etc., has to be made for safe execution of job.Required size of scaffolding has to make/ erected before taking of job.

There are no extra costs of scaffolding making and removal is to be paid to contractor. Making and removal of scaffolding is under scope of contractor.

II. This item is meant for removal of any unused mechanical equipment and connecting structural material etc.

III. This job includes cutting of old plates/structures from the location and shifting to scrap yard of stores after making to suitable sizes as decided by EIC.

IV. Work has to be carried as per the guidelines of department.

V. All the plates, structures required have to be cut to a required size by gas cutting / arc cutting.No extra payment for cutting in all the items of this contract.

VI. Measurement will be done in MT.

VII. For removal of air flue path duct plate; After thickness measurement department person will identify and decide the location and part of the existing duct plate to be removed. The duct plate has to be cut with gas cutting. Before cutting the plate, it has to be held firmly by means of clamps anchors without slipping down to the ground. After gas cutting plates are to be brought down to the ground level safely. All the plates removed are to be cut to suitable sizes as specified by stores and to be shifted to scrap yard or identified locations as per the directions of the department of stores.

Item No. 11) Removal and Replacement of damaged SS expansion bellows:
The Job involves the following works

a) **Removal of old and damaged expansion bellows**: - work front will be given to contractor, after removal of cladding sheets and insulation. After removal of old insulation and cladding sheets, the duct and expansion bellow area is to be cleaned thoroughly by the contractor. Cleaning tools like wire brushes; scrappers etc are in the scope of contractor. After cleaning, the damaged expansion bellow is to be removed from position by gas cutting and to be lowered to the ground. The removed expansion bellows are to be disposed to designated place/stores as scrap after cutting them into pieces of sizes as decided by stores.

b) **Pre Fabrication of New bellows**: - Expansion bellows / plates will be supplied in lengths of two meter each segment by Department. These segments are to be sized by joining at ground level as per requirement. The joining of segments is to be done by TIG welding by using filler wire ER-316. Required Argon gas and filler wire is in the scope of contractor. The supplied expansion bellows are of Stainless Steel make and having MS strips which were stitch welded to these Stainless-Steel bellows. So, these stitch welded MS strips are to be welded along the length completely (full welding).

All corners are pre-fabricated with TIG welding without any overlapping (SS to SS welding). The expansion bellows' ends are be welded with MS flats (SS to MS welding) for straight joints at location (MS to MS welding). The bellows will be supplied in single or multi looped segments as per site requirement. All the arrangements for joining the single or multi looped segments are in the scope of contractor. Measurement will be taken based on length of the expansion bellow after erection irrespective of number of loops.

c) **Alignment of Ducts**: - During replacement of damaged expansion bellows the ducts if any are found misaligned condition the same are to be aligned properly. The arrangements for aligning the ducts like welding of hooks, anchoring of ducts with appropriate chain pulley blocks etc is in the scope of contractor only. Required plates for fabricating hooks will be provided by department on free of cost.

d) **Erection of pre-fabricated expansion bellows at location: -** The pre-fabricated expansion bellows are to be shifted to location and alignment is to be done. Another MS flat is to be used to connect expansion bellow and the supporting frame. Initially tack welding is to be done to achieve proper alignment. After alignment, full welding is to be done. No leakage or ingress is allowed after completion of work.

Item No 12) Removal and Replacement of damaged expansion bellows(MS):

The Job involves the following works

a) **Removal of old and damaged expansion bellows**: - work front is given to contractor after removal of cladding sheets and insulation. After removal of old insulation and cladding sheets the duct and expansion bellow area is to be cleaned thoroughlyby contractor. Cleaning tools like wire brushes; scrappers etc are in the scope of contractor. After cleaning, the damaged expansion bellow is to be removed from position by gas cutting and to be lowered to the ground. The removed expansion bellows are to be disposed to designated place/stores as scrap after cutting them into pieces of sizes as decided by stores.

b) **Pre Fabrication of New bellows**: - Expansion bellows/ plates will be supplied in lengths of two meter each segment or as a whole by Department on free of cost. Plates supplied shall be bent to the required profile matching the expansion bellow using specially fabricated die or bending machine. Bending of expansion bellows/ plates shall not be permitted by hammering. These segments are to be sized by joining at ground level as per requirement. The supplied expansion bellows are of MS make. All corners are pre-fabricated to required sizes. The bellows will be supplied in single or

multi looped segments as per site requirement. All the arrangements for joining the single or multi looped segments are in the scope of contractor. Measurement will be taken based on length of the expansion bellow after erection irrespective of number of loops.Some of the old expansion bellow was lying at store from long time. These expansion bellows are drawn from the store. These expansion bellow need to be re-conditioning by removal of damage plate and welding with new supplied plate and its flange/MS flat orientation is to change as per existing structure. After re-conditioning of bellow, it shall be made fit for erection and commissioning. There are no separate payment/measurement is recorded for re-conditioning of old expansion bellows. Measurement is recorded as per linear length of expansion bellow not in terms of linear welding and cutting during reconditioning of bellows.

c) **Alignment of Ducts**: - During replacement of damaged expansion bellows, if any ductsare found misaligned condition, the same are to be aligned properly. The arrangements for aligning the ducts like welding of hooks, anchoring of ducts with appropriate chain pulley blocks etc is in the scope of contractor only. Required plates for fabricating hooks will be provided by department on free of cost.

d) **Erection of pre-fabricated expansion bellows at location: -** The pre-fabricated expansion bellows are to be shifted to location and alignment is to be done. If required another MS flat is to be used to connect expansion bellow and the supporting frame. Initially tack welding is to be done to achieve proper alignment. After alignment, full welding is to be done. No leakage or ingress is allowed after completion of work.

Item No 13)Thickness measurement of pipe/duct/bends:

a) Thickness of air and flue gas ducts, bends, pipe, coal pipe and bellows has to be measured at different locations at identified points for assessing the condition of the duct.

b) Department staff will identify the locations where thickness is to be measured.

c) Department staff will measure the thickness of the ducts using thickness measuring instrument (UT).

d) Contractor should clean and prepare surface at located points for measuring the thickness.

e) Surface cleaning and preparation has to be carried out with emery sheet or buffing wheels as required by the department inspector.

f) Thickness survey to be recorded by the contractor. Thickness survey report shall be prepared and submitted to EIC of work for bill preparation. Without thickness survey report bill cannot be prepared.

g) Required thickness measuring instrument (UT) is under supply of contractor. There are no separate payment is made for arranging UT instrument. Contractor has submitted the calibration certificate to EIC of work before starting of thickness survey. In case EIC of work has any doubt for replacing of machine same shall be replaced and decision on UT instrument uses final by EIC of work.

GENERAL POINTS

a) This scope of work shall read along with ***WELDING REQUIREMENTS FOR THE FABRICATION OF PIPING given at end.***

b) The contract is meant for execution of modification jobs in CPP area includes cutting, welding, erection of stair / stair cases/ pipelines, pipe fittings along with valves erection positioning, flange jointing etc. Contractor should note that work is mainly cutting of existing structure / lines, dismantling any existing structure / pipe line flanges, valves and handling them may also be require and same shall be the part of the contract. Fabrication of supports at required location either temporary support during erection and permanent support after erection is also included in the contractor's scope.

c) HWPM Engineer In-charge shall provide contractor with a sketch/ sample pieces of work to be executed and the same shall be strictly followed. However exact conditions at site shall be the final governing criteria. The contractor shall obey all safety precautions as advised by HWPM Safety Officer. Contractor shall note that preparation and submission of as built drawing is compulsory on their part after completion of work.

d) Contractor shall not attempt to start the work, unless EIC of work qualifies their welders for such jobs as per HWPM/WAS/01. Over and above all test welds shall be examined for the following.

Root run DP test 100%

Final runs DP test 100% after cleaning and dressing of any extra reinforcement andspatters.

e) The welding procedures that are to be followed are indicated in the annexure as WELDING PROCEDURE NO. HWPM/WAS/01.

Welding requirements for fabrication and piping edge preparation, fit-up and alignment, root pass welding, stabilizing pass and filler passes are to be strictly followed. Weld area cleaning/dressing to remove excess reinforcement and grinding on inside of pipe

lines/fittings for reducing and thickness miss-match is also in contractor's scope. Taper shall be min. 1:3 and transition shall be very smooth.

f) All welders that are to be employed by contractor shall be qualified at HWPM site by making welding joint for testing purpose. All test required for welder qualification and subsequent documentation are to be arranged by contractor.

g) Carbon steel material, available in HWPM stores, may be either **A-106 Gr. B** pipes or **A-105 Pipe Fittings** of different schedules. HWPM Engineer In-charge shall decide the right material and fittings combination and it shall be binding on the part of contractor.

h) Erection of structure / stair / stair case / pipeline may be done in pre-fabricated form or by joining the different parts in-situ. Provision of expansion loops expansion joints, sliding support anchoring etc. shall be as per the decision of HWPM Engineer In-charge.

i) Inspection by DP testing shall be as per the directives of HWPM Engineer In charge. However entire documentation, processing and manpower required (including chemical) for DP test shall be arranged by contractor. **ASTM -sec. V** shall be guiding code in case of any discrepancies. Contractor shall use only SS Clamps during welding of SS material for edge alignment.

j) Contractor cannot claim any extra payment for following works, which are to be carried out as part of welding job.

(i) Grinding at a taper not less than 1:3 in pipe lines/fittings inside surface to bring the edge miss-match on inner dia within 1/32".

(ii) Dressing of weldment to remove extra reinforcement and spatters.

(iii) Fabrication & installation of supports for newly fabricated & erected pipelines.

k) The conditional tenders are liable to be rejected.

l) The contractor shall furnish a separate schedule listing out their man power/ material resources in the form of a separate annexure.

m) The contractor has to provide his active mobile number and active e-mail address to EIC in writing on contractor’s letter head. Intimation regarding work front may be given by the department through SMS on the mobile number provided by the contractor or on the mail address of the contractor. Work front once allotted, contractor shall have to make all efforts to complete within the specified time period and shall provide the daily progress report to the EIC.

n) Scaffolding of any height up to 15 m, wherever required, is to be made by the contractor after obtaining the approval from EIC. The job involves the following activities:

(i) The scaffolding required to be made to have sufficient strength with standard material for cleaning, Inspection, repair and painting.
(ii) Approach ladders are to be made for approaching the location.
(iii) Standard thickness scaffolding pipes and clamps, wooden planks are to be used for making the platforms.
(iv) Scaffolding pipes (IS-1239 blocks) of medium schedule shall be used for the purpose of making scaffolding. These pipes shall be 1 ½" NB and should be not be rusted or should not be in damaged condition.
(v) Put-log couplers and swivel couplers shall be used for making a temporary structural erection.
(vi) Horizontal spacing between any two horizontal members shall not be more than 1 meter unless otherwise restricted.
(vii) Platform structure such erected shall be sufficiently rigid and strong wooden planks shall be used for making the deck. Such planks shall be teak wood or seal wood or iron grills of 1 ½" thickness and minimum 1 foot wide and 5 feet long. There shall be no joint in between a plank throughout the span of its length. Nailing of planks or tying with manila rope is essential in order to prevent slipping of planks from the position.
(viii) Contractor shall be allowed to start the scaffolding work after all the material to be used for the purpose of making scaffolding are available at site.
(ix) All the materials are to be brought by the contractor for this purpose. All scaffolding material supplied by contractor for making scaffolding will be inspected and tested by the department, safety personnel and after concurrence of the concerned section only he will be allowed for taking up the job. Contractor shall obtain acceptance/clearance certificate of these materials from department. Department shall provide the scaffolding material on chargeable basis in case availability of material at site at the time of requirement by the contractor on request. Contractor willing to avail the scaffolding material from department they shall submit a request letter for issue of scaffolding then only scaffolding material will be issued to contractor.
(x) Scaffolding must containing separate ladder with hand railing. Monkey ladder shall not be accepted in scaffolding. Toe guard, two layer of hand railing must be provided. Cross bracing and diagonal bracing in scaffolding must be there to ensure the rigidness of scaffolding this is the basic feature of scaffolding. Bottom of scaffolding shall contain one base plate and wooden sleeper plate. Scaffolding shall be rigidly anchored to nearest rigid structure with minimum 4 anchoring point.
(xi) Contractor has to remove the total scaffolding from the locations after completion of all jobs and inspection and clear the work site of any debris generated during the work.

WELDING REQUIREMENTS FOR THE FABRICATION OF PIPING

SCOPE :

a) This specification defines the requirements concerning welding of piping for the Heavy Water Plant (M). It is applicable to shop welding at site or elsewhere, and to field erection welding.

b) The requirement stipulated is based on review of piping systems and materials specified from the construction at the time of writing this specification. Any subsequent design changes or authorized materials substitutions will require review of the appropriate sections of this specification and the issue of amendments, if required.

WELDING PROCESS:

a) All piping shall be welded using either the submerged arc welding process (SMAW) or GTAW OR a combination of the two as per relevant WAS.

b) Any other welding process, if proposed by the contractor shall require specific approval of the HWPM Engineer.

QUALIFICATION AND PERFORMANCE RECORD OF WELDERS:

a) All welders working on plant piping shall have passed the performance qualification test prescribed by section IX of the ASME Boiler and pressure vessel code.

b) The quality survey or /Engineer-In charge, HWPM shall have the right to call for further qualifications from time to time, from any welder who, in surveyor's opinion is not producing finished welds in accordance with his qualifications, or who has discontinued welding by the particular process for more than three months.

c) For each welder, a record card shall be maintained showing the procedures for which he is qualified. These cards shall show the date on which each procedure is used, the types of defects produced and their frequency. This record shall be reviewed once a week by the quality surveyor and those welders whose work requires a disproportionate amount of repair piping joints.

   Re-qualifications of welders disqualified more than three times shall be entirely at the discretion of the quality surveyor.

d) When repairs are to be made, the welder whose work is defective shall have the nature of the defects explained to him. It is preferable if a welder can repair his own defective welds.

e) Each welder shall be assigned a letter, number of symbol. Each weld shall be clearly identified as to its welder either by marking on the pipe adjacent to the weld or by maintaining a chart on which every weld is detailed.

GENERAL WELDING REQUIREMENTS

a) No welding shall be done on surfaces, which are wet or exposed to rain or excessive draft. Surfaces to be welded shall be free from paint, rust, oil, grease dust or any other contaminations.

b) Welds shall be cleaned between passes to remove all traces of slag and flux before successive beads or layers are deposited. Completed welds shall be cleaned to the same extent. The craters at the starting and stopping points of each individual bead shall be carefully examined and any defects shall be removed by grinding wheels, wire brushes, chisels etc, for use on stainless steel shall not be used on any other materials. The grinding wheels should be iron free and the wire brush should have bristles of austenitic stainless steel to avoid iron contamination of the stainless-steel surface.

c) Peening shall not be permitted, in general.

d) Any dams used in purging shall be placed in such a position that they can be removed intact. The burning out of dams will not be permitted. Dams shall be numbered and accounted for eliminate the possibility of leaving them in the system, unless the same are consumable type dams.

e) Inspection and quality surveillance shall not be limited to examination of the finished weld. All aspects of the materials, fabrication procedures and examination procedures used, that could affect the quality of the finished weld shall be subjected to the approval of the quality surveyor. The equipment to be used shall be suitable for the quality of work specified and the technique employed shall be based on methods which are known to produce good results and which have been verified at site by actual demonstration.

f) The welding technique and manipulations shall be controlled to ensure the following:
   1. Full penetration weld.
   2. Full fusion into the proceeding bead or layer.
   3. Full fusion into the base metal without under cutting along the side of the weld.
   4. Uniformity of surface in both single run passes and beaded layers.
   5. Floating all slag, oxide & gases to the surface behind the advancing arc.
   6. Delay in electrode travel until base metal fusion at the starting point is assured and until the crater is well filled at the completion of the weld.
   7. Minimum spatter generation.

g) Haphazard striking or the electrode on the base metal in establishing the arc shall not be permitted. The arc should be struck either in the joint where the metal surface will be fused into the weld or on a starting tag. Starting tag shall be of the same metal surface will be

fused onto the weld or on a starting tag. Starting tag shall be of the same material or material compatible with the base metal being welded. When inadvertent arc strikes occur, the area affected shall be ground flush and then examined by the liquid penetrate method. High frequency arc starting devices shall be used for GTAW welding.

h) Care must similarly be taken when stopping the arc to avoid an unfilled crater and crater cracks. The following techniques are recommended for stopping the arc: -
   1. The arc should be drawn off to the side of the joint and stooped on the beveled surface of the joint while extending the arc length rapidly.
   2. In GTAW welding, the machine should ideally be equipped with a foot or hand control to permit a gradual decrease of current. It is then easier to fill the crater completely and prevent crater cracks.

i) When welding stainless steel, a stringer bead technique shall be used with a slight oscillation of necessary to avoid entrapped slags and to minimize the number of beads needed to fill a joint. Because of the height, sufficient of expansion lower thermal conductivity of stain less steel, it is necessary to take some precautions to reduce distortion. Skip welding, back step welding or effective tack welding beforehand are the usual methods used. Control of inter pass temperature is also used. The method to be adopted shall be stated in the welding procedure.

j) When welding carbon steel with covered electrodes, the width of the deposited pass shall not exceed 03 times the core wire diameter

k) Vertical welds shall be made in an upward direction on pipes over 300mm (12") in diameter, welding shall be done whenever possible by two welders working simultaneously on both side of the pipe.

l) In GTAW welding, the electrode must be correctly shaped pointed for DC welding. The electrode extension beyond the gas cup should be kept as short as is consistent with the joint being welded. The welding torch should be inclined slightly in the forehand welding position and the filler metal added carefully to avoid contact with the consequent contamination of the tungsten electrode. If contamination does occur., the tungsten electrode shall be cleaned and redressed. Similarly, if the tungsten electrode comes in to contact with the weld pool the operator shall break the arc and grind out the tungsten deposit.

JOINT DESIGN:

a) In all instances, the edge preparation for welding shall be as per the Engineer In charge's drawings.
b) Where counter boring or any other machining is done, the remaining wall thickness of pipe or fittings shall not be less than that shown on the joint design drawings.
c) All circular butt-welded joints shall have their end preparations formed by machining preferably on the lathe. Machining equipment to be used for this purpose must achieve the accuracy specified for the particular end preparation. Joints of other geometry may be prepared by drilling and grinding.
d) Where the circumstances do not permit machining or grinding flame cutting may be used on carbon steel material to form the end preparation, provided the cut edge is ground back at least 1/16 inch below the deepest identification. To reduce edge mismatch at inner diameter grinding at inside portion near the edge at a taper not less than 1:3 shall be taken up, so that any two mating ends at any joint shall have edge mismatch, inside, within 1/32".

FIT UP:

a) All welded joint fit ups shall comply with the tolerances specified on the design drawings.
b) Prior to starting fabrication, the relevant specifications for materials shall be studied to establish the tolerance on supplied materials and their compatibility, with specified fit up tolerances.
c) Before fitting up the weld joint, the profile and dimensions of the weld edge preparation shall be checked if the specified tolerance is exceeded this shall be corrected by grinding or machining.
d) All fit ups shall be examined by the quality surveyor prior to welding the root pass.

WELD PROFILE:

a) Butt welds shall have full edge penetration and the weld thickness shall exceed the minimum wall requirements of the pipe. The external surface of the weld shall be free from undercuts, overlaps and abrupt ridges or valley. The weld metal reinforcement on the outside surfaces over the pipe shall not exceed the following limits.

Component thickness (mm)	Maximum re-enforcement
Upto (1/2") 13mm	(1/16") 1.5 mm
Over (1/2") to (1") 13 mm	(3/32") 2.38 mm

Over (1") to (2") 25 mm	(1/8") 3.18 mm
Over (2") 50mm	(5/32")3.97 mm

b) The reinforcement shall be crowned at the center and shall taper smoothly to the surface being jointed.

c) The surface smoothness of the finished weld shall be suitably for proper interpretation of the non-destructive examination of the weld. If grinding is necessary, the weld shall be blended into the parent metal without gouging or thinning the parent metal in any way. Uneven or excessive grinding may cause rejection or rework at the discretion of the Inspector.

d) When components of different outside diameters are welded together there shall be a gradual transition between the two surfaces. The length of the transition may include the weld. The slope of the transition shall be such that the length to off set ratio shall not be less than 3 to 1. The same work is in contractor's scope.

e) The root pass of butt welds made without inserts shall have less than 1/16" internal re-enforcement defects such as undercut, burn-through and excessive suck-back etc shall be cause for rejection of the weld.

f) The root pass of butt welds made with insets shall be essentially smooth on the inside of the pipe and shall show no crevices or abrupt changes in section. The internal reinforcement shall not exceed 0.75 mm (1/32").

ATTACHMENT WELDS.

Temporary attachments shall be removed in a manner that will not damage the pipe. The removal can be done by grinding, chipping, sawing on in the case of heavy weldment by arc cutting. The attachments may be reduced to a very small cross section and then the attachment may be knocked off. Knocking-off of the full-size attachment welds or tacks is not permissible. When arc or flame gouging is used at least 3mm (1/18") of metal shall be left free of the pipe surface, which will then be removed by grinding. Such gouging shall be done for removal of defect.

TACK WELDS.

a) All tack welds shall be made using a qualified procedure and qualified welders. Any pre heat requirements specified in the welding procedure shall also apply to tack welds.

b) The number and size of the tack welds shall be kept as small as is consistent with adequate strength and joint alignment.

c) All tack welds shall be examined visually for defects and if found defective shall be completely removed.

d) After completion of welding tack welds shall be either removed completely or shall be properly dressed by grinding or filing.

REPAIRS

a) Any weld repairs shall be subject to the approval of the quality surveyor.

b) Unacceptable defects shall be removed by grinding, machining or chipping. Arc gouging or flame cutting are also permitted provided gouged surfaces are ground back at least 1.5 mm (1/16") below the deepest indentation.

c) If pre heat is specified in the appropriate welding procedure, then the same preheat must be maintained during flame or arc gouging.

d) Dye penetrant examination shall be used to check that the defect has been completely removed prior to weld repair, in the event of any doubt regarding complete removal of a defect, radiography may be required at the discretion of the quality surveyor.

e) Weld repairs shall be made using qualified procedures and welders. The preparation for the weld repair shall have the prior approval of the quality surveyor.

f) In the event of several unsuccessful repair attempts or of the quality surveyor feels that a satisfactory repair is not feasible the joint shall be completely re-made.

g) The re welded area shall be examined by the methods specified for the original weld. Where radiography is required, a minimum amount or 50mm (2") film overlap beyond the repair edges must be ensured.

h) Repair of any base materiel utilized in fabrication of piping shall not be undertaken unless specifically permitted by the quality surveyor.

FILLER METALS / ELECTRODES.

a) The filler metals/electrodes are in the scope of contractor. The brand of electrodes to be used shall be submitted for the approval by the Engineer. For each batch of each approved brand, certificates showing compliance with the specification shall be secured and shall be submitted to the quality surveyor before being released for use on plant piping.

b) All electrodes shall be stored in their original sealed containers and under dry condition (50% max. relative humidity) the electrodes shall remain identified until consumed.

c) All electrodes shall be dried before use in accordance with manufacturer's instructions. Drying ovens shall be provided in work areas for this purpose. Each lot of electrodes withdrawn from the oven shall be used within two hours. Electrodes shall not be left at

work locations whether in metal containers or otherwise. In the event of electrodes are left out for period longer than two hours they shall be rebaked following the electrodes suppliers rebaking procedure.

d) Electrodes, which have been exposed, to rain or which have been otherwise exposed to water however shall be discarded. No re-baking of such contaminated electrodes will be permitted.

e) For systems where a high-quality butt-welded joint is required, consumable inserts are specified. More consistent control of the chemistry and microstructure of the root pass can be obtained by using inserts than by any other method. Gas purging is necessary and the insert shall be fused using the GTAW process. Gas purging is not necessary at the tacking stage.

SHIELDING AND PURGING GAS.

a) Argon gas used in GTAW welding for shielding shall be at least 99.95% pure.

b) The rate of flow for shielding purpose shall be established as per WAS.

c) Purging gas is required in the GTAW process to protect the underside of the weld and the adjacent base metal surface from exudation during welding. The purity of the gas for this purpose shall be 99.6% minimum. When purging, a high gas pressure is not desirable. The requirement is for a small gas flow to maintain the purge whether the GTAW process or a combination of GTAW and SMAW is specified for a particular joint. The purge shall be maintained during welding of the root pass and from two subsequent passes to minimize oxidation to the inside surface of the pipe.

d) Purging at a flow rate of approximately 0.283 M cube/hr.(10 cubic feet /hr.) per inch diameter until 6 times the volume of the section of piping between the dams has been replace is usually adequate. In no case should the initial purge be for less than 10 minutes.

e) After initial purging is completed, the flow of purging gas during welding should be reduced to a point where only a slight positive pressure prevails. For system which have a small volume 1.43 Ltrs up to 1/2" cub.FT to be purged during welding, a gas flow rate of 5.66 to 14.15 litres/hr. (2-5 cu-FT/hr) is usually adequate. Systems of larger volume may require higher flow rates and these should be established at the procedure qualification stage.

f) Gas purging is not required on socket type welded joints.

EXAMINATION METHODS AND REQUIREMENTS.

a) The type and extent of weld examination shall be as per WAS of this specification.

b) All non-destructive examination shall be done to a detailed written procedure that has been qualified by actual demonstration as capable of detecting and locating discontinuities described in this specification as unacceptable or as required to be reported. The procedure shall comply with the requirements described in the relevant appendices of this specification covering the particular examination method. An adequate number of copies of the procedure shall be readily available to all applicable nondestructive examination personnel for reference and use.

c) Following any nondestructive examination in which foreign material is applied to the surface the surface shall be thoroughly cleaned in accordance with the applicable material or fabrication specifications. Cleaning shall be done immediately following the quality surveyor's inspection of the test in question.

d) All personnel performing any non-destructive examination shall be competent and knowledgeable of the applicable examination requirements and shall be qualified in the general technique and to the specific procedure. The QUALITY SURVEYOR shall have the right to ask for re-qualification on change of any person who in his opinion is not performing satisfactorily.

e) For non-destructive examination methods that consist of more than one operation or type it is permissible to use personnel qualified to perform one or more operations. One person may be used who is qualified to conduct the examination and another may be used who is qualified to interpret and evaluate the examination results. The qualification certificate shall describe this in detail.

VISUAL EXAMINATION:

a) Visual examination is of the first order of importance; its purpose is to ensure the conformity of the weldments with all provisions and requirement of the specifications and welding procedure. Visual examination as called for in Appendix-E is only art of the visual examination requirements of this specification.

b) This method of examination shall extend to cover at least the following steps: -

1. Base metal identification
2. Base metal defects, if any such as surface irregularities, cracks laminations.
3. Filler metal identification and verification for any defects.
4. Joint fit-up
5. Cleanliness
6. Taching

7. Purge provisions
8. Root pass and subsequent passes appearance
9. Cleaning between passes
10. Pre-heat inter pass temperature and heat treatment control
11. Appearance of completed welds, their conformity with drawings and specifications and suitably for subsequent methods of examination.
12. Condition of base metal in the area adjoining the weldment
13. excessive or unexpected distortion due to welding.

c) Any deviation from the specifications and approved procedure shall be immediately reported to the quality surveyor and his decision obtained prior to proceeding with the next step of the work.

LIQUID PENETRANT EXAMINATION

a) Liquid penetrant examination shall conform to the requirements of ASME Sec.V.

b) The penetrant, cleaner and developer shall be tested and certified as having acceptably low halogen and Sulphur contents.

ACCEPTANCE STANDARDS

1. VISUAL EXAMINATION.

The acceptance standards for visual examination shall be as described in the specification.

2. LIQUID PENETRANT EXAMINATION

a) The following defects exceeding the limits stated hereunder are unacceptable:

b) Rounded indications due to surface porosity of slag including with dimensions greater than 4.7mm (3/16")

c) Other indications shall be investigated to determine their nature and acceptability at the desecration of the quality surveyor.

DEPARTMENT'S SCOPE OF SUPPLY

All the structural Materials to be used in fabrication (other than consumables like – welding electrodes, welding gas, grinding wheels, DP kits and all sorts of tools and tackles required for execution of the job) shall be provided by the department. This structural material shall be provided to contractor at DPS store / departmental store. Shifting the structural material from store to the site of work is purely in the scope of contractor. The materials, which are given to contractor are meant for the specified job only, and shall not be kept/diverted for any other purpose. Excess material, in unused condition shall be handed over back to department representative and shall be shifted to departmental store, by contractor, in safe conditions as

per the direction of department representative.All these materials shall be shifted by contractor from HWPM stores on production of RCIV forms duly approved by EIC. All scraps that are generated shall be returned to HWP (M) stores with proper segregation like CS/SS/CI material vide Credit vouchers. Any loss/damage noticed shall be recovered from contractor's bill as per discretion of General Manager HWPM.

a) MS,CS,CI or SS pipe lines, all types of fittings or structural steels, valves, orifices, flanges with orifice etc.

b) Electric power supply required for carrying out of the work shall be made available free. Such source (plug point) shall the nearby available supply point from the location of the work spot. Contractor shall have to make their own cable arrangements for tapping and laying further cables for distribution through a main switch, fuse and distribution box. Contractor's electric installations shall be checked by HWPM and if found un-safe, supply shall be disconnected.

c) Filtered water shall be made available to the contractor at suitable locations. Hose requirement shall be responsibility of contractor at their cost.

d) Following un-accountable losses shall be allowed:
   - Pipes - 0.5% on total length of each type
   - Fitting - Nil.
   - Structural items - 0.5% on each meter.
   - Bolts/nuts/gaskets - Nil
   - Special tools, torque wrenches - Nil

e) Following items shall be considered as returnable items and contractor shall arrange to put back these at location to be shown by HWPM stores personnel at the time of return receipt.
   - Any pipe having straight length and edges in beveled condition if more than 1.0 M, no joint in between shall be accepted.
   - Any structural item more than 1.0 M in straight length and in original shape.
   - Pipe fittings, valves, etc. in unused, in original shape and original condition.
   - Plate off-cuts having dimension more than 0.5 M in all sides and area more than 0.5 sq.m.

f) Molykote / Grease, studs, gaskets, air.

CONTRACTOR'S SCOPE OF SUPPLY

Following materials and services shall be in the scope of contractor while carrying out the contracted job. However, scope is not limited to the following specified materials/services

only as contractors shall have to make all sorts of arrangements as may be deemed necessary to continue and complete the assigned job. All types of consumables for NDT like DP testing materials shall be in contractor's scope.

a) All kinds of required hand tools, lifting tackles, wire ropes, pulley blocks, chain pulleys manila ropes, hoses, D-Shackles and gloves, helmets, safety belts guards, etc shall be arranged by contractor. Contractor staff shall be able to use all type of general industrial tool confidently. Test certificate of all lifting tools and tackles shall be submitted to EIC of work before start of job.

b) All type of industrial gases such as O_2, acetylene, Argon N_2, grinding wheels etc along with equipment, **all kinds of welding electrodes (MS, CS, SS, CUTTING ELECTRODES, dis-similar electrode for welding MS and CI and filler wire)** shall be arranged by contractor. Quality of the electrodes shall be get approved by EIC before execution of the job. Only electrodes of standard make confirming to AWS / IS will be permitted for use.

c) All materials required for making temporary platform structures for attending to valves, or pipe flange joints or spring etc. shall be in the scope of contractor. The rate quoted for individual items shall include the scope of making temporary plat forms / scaffoldings also wherever required. Contractor has to make scaffolding as per the instructions of the department.Scaffoldings made will be inspected by the department for 'FIT FOR USE' certification as per scaffolding checklist. Work for welding to be started only after 'FIT FOR USE' certification by the department Engineers / EIC.

d) Arrangement of all types of consumable, like wire brush (CS & SS both varieties) emery paper, cloth waste, cleaning/rust loosening agents, hand scraping tool, pullers, marking blocks, Argon gas, dividers, cotton waste, measuring tapes etc. Letter punch, hole punch, shall be the responsibility of contractor. All types surfaces cleaning facility shall be in contractor's scope.

e) All kinds of hoses, adapter nipples, electric lamps for lighting electrical appliances like electrode oven welding machines, grinding machines, etc power plugs main switch board regulator etc. shall be arranged by contractor.

f) All safety gadgets shall be provided by contractor for their staff at their cost. This includes shoes hand gloves, eye shields, helmets safety belts and apron.

g) Contractor shall arrange Cotton rags, waste, cloth rust preventive liquid, CTC, kerosene or diesel for cleaning.

h) All kinds of riggers,Kalasies, Millwright fitters, Welders,Maint. Personnel, site Engineer, site supervisor, etc. shall be arranged by contractor.

i) Grinding M/c with attachments, welding M/c with attachments & consumables and all inspection tools.

j) Police verification certificate (PVC), height pass, gate pass and safety pass are to be arranged by the contractor to all their workers as per existing guidelines in the plant.

WELDING PROCEDURE NO. HWPM/WAS/01

A.Weldingprocess :-**GTAW - SMAW**.

B.Type manual deposition material- carbon steel.

1) **Joints :** Groove design - Single "V" (No backing).

2) **Position** : All positions &up hill welding progression.

3) **Base metal** :**A-106 Gr.B** to **A-106 Gr.B**(P.No.1 to P.No.1) thk. range 6.37 mmto 24.6 mm.

4) **Preheat :** If the ambient temp. below 16 dig.cent.Gr. base metal shall be pre-heated to hand holding temperature, inter pass temp. should be 150 deg.cent.Gr.

5**) Filler metals** : **ASW No-E-7018**-spl. size : 2.5 mm dia & 3.1 mm dia spec. No.(SFA) - 5.3,5.18,5.1. Filler wire : 1.6mm dia& 2mm dia wire root pass.

Welding shall be done by using 4mm dia, 2% thoriated Tungsten rod in holder tip. Electrodes/flux shall be iron powder.
Consumable insert shall be "Y" type, GTAW process shall be used for root pass and one more stabilizing pass. Balance shall be with SMAW process.

DRYING OF ELECTRODE/FLUX :

I. Temperature - 250 deg.c..
Ii. Duration 2 to 3 hours.
iii. Holding temperature in electrode oven(Portable)-- 80 to 100^0 C. Electrode shall be taken out from oven only prior to welding job.

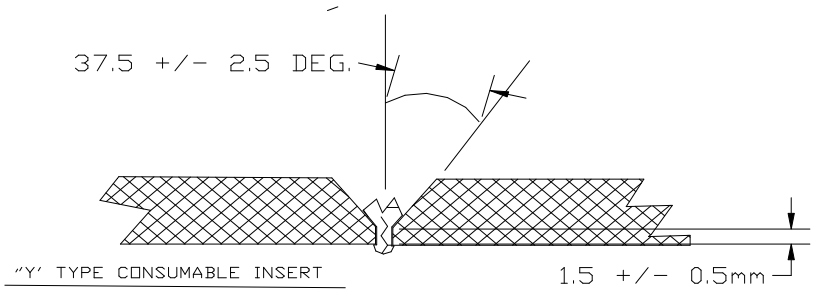
6) PHWT:

i.Soaking temp. - 620 + 0r - 5 deg.c
ii.Soaking period 0 1 hr.min.
iii.Heating rate - 200 deg.c per hour max.
iv.Cooling rate - 200 deg.c per hour max.

and controlled cooling in power cut off but in insulated condition from 350 deg.c to ambient condition.

7) **GAS**: Shielding gas shall 99.99% pure Argon gas at 10-12 CFT/hr. flow rate. purging gas also shall be 99.995% pure argon and the flow rate shall be as follows.
Initial purging/scavenging of entrapped air between dams shall be done at 20-25 CFT/hr. rate 6 times. Purge rate during welding shall be 6-10 CFT/hr. per in NB of pipe line /joint.
8) **TECHNIQUE**:
String or wear bread :- Stringer root wear bead filler (subsequent pass).
Initial & inter pass cleaning :- Grinding and wire brushing, no back gouging and oscillation during welding required.
Pass :- Multiple pass welding.

Electrode :- Single electrode
Travel speed :- At root 3.5 cm to 6.5 cm/min. & filler pass shall have speed of dispersion as 4 cm to 10cm/min.
9) **Electrical Characteristics** :-
a) Current - D.C
b) Polarity - GTAW---S.P, SMAW---R.P
Job shall be performed as per the joint sketch attached.
10) **Groove design**:



Max. permissible mismatch at root inside diameter= 1/32".
Sequence of welding - GTAW for fusing consumable insert & GTAW for stabilizing pass by using E-7018-spl. electrode of 3.15 mm dia red.
Ampere range - 100 to 140 A
Voltage range- 18 to 25 V.
However for weld deposition repair of valve flanges and pipe line flanges contractor should obtain specific approval of HWPM Engineer In-charge for exact detail of welding technique & electrode to be used.
Similarly for structural welding purpose, the common method to be adapted is fillet welding by using E-6013 electrode of 3.15 mm dia. Minimum filled size acceptable to HWPM Engineer In-charge is 8mm.Chipping of old slag & spatter removal is essential after welding.

Payment and Billing Terms

1) RA bills/Final bill will be prepared only after submission of bill by contractor giving details of measurement duly certified by departmental supervisor / engineer.

2) Contractor has to prepare the measurement in hard copy and also prepare in the excel sheet. Both excel sheet of soft copy and hard copy (which is dully certified by departmental supervisor) is to be submitted to the EIC of work for preparation of bill.