:91-22-25591121(dir.)
Telephone: 91-22-25591015
: 91-22-2550 5185
Fax Number

GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
Nuclear Recycle Group

Ref.: BARC/NRG/TDD/DF/P&V/2017/75548 **Dt: 05/05/2017.**

Dear Sir,

Sub: Enquiry for minor fabrication work.

We require the following work to be carried out on urgent basis:

S. No.	Description of work	Remarks
1.	Procurement of raw material (Other than FIM) fabrication, inspection and testing of SS piping, ventilation and other structural works at RSMS-BARC as per technical specification and scope drawings.	The work shall be completed within **4 (Four) Months** of issue of the work order.

If interested, please submit your most competitive offer for this work, in a sealed envelope duly writing our letter reference number, on or before **15.30 hrs on 22/05/2017**. The offers will be opened on the same day at 16.00 hrs. in the office of A.A.O, Accounts Works, NRG, BARC, Trombay.

1. Technical requirements of the works are mentioned in our technical specification.
2. Free Issue Material (FIM) will be given by the department as mentioned in Sch. A of the technical specification for this work. Except FIM, complete material is required to be arranged by the contractor.
3. The work shall be completed within **4 (Four) Months** of issue of the work order.
4. Income tax @2% and S.C on the I.T, as applicable and educational cess on IT and SC, as admissible will be deducted from your bill.
5. The enquiries should be sent only by **speed post** and should be addressed to following address:

Yogendra Singh,
Scientific Officer-C
Room No. 313, CDCFT Building
TDD, Nuclear Recycle Group
Bhabha Atomic Research Centre, Trombay, Mumbai-400085
Ph no 022-25591121 /25591015
Email: singhy@barc.gov.in

The Enquiries sent by any other mode (e.g. manual, courier etc) shall be rejected without assigning any reasons as per terms and conditions of Accounts, BARC.

The offer shall be kept valid for a period of 45 days from the date of opening. All taxes, levies and transportation charges if any, shall be brought clearly in your offer. Please note that BARC is exempted from paying excise duty and octroi duty. Accounts Officer, BARC, shall provide necessary certificate to this effect. Hence, your offer shall not include excise duty and octroi duty component and, if applicable, the same shall be indicated separately.

Full payment shall be made only after successful completion and acceptance of the work.

(Yogendra Singh)
SO/C, TDD, NRG
Phone: 022-25591121 (Direct)
022-25591015

TECHNICAL SPECIFICATION
FOR
PIPING AND VENTILATION WORK AT DF-RSMS

Table of Contents

Contents

ANNEXURES:

1. SCOPE OF WORK:

a. Supply of supporting structures (angle/ channel/ plate/ rod/ fasteners), fabrication, epoxy painting and installation for ducting, piping and equipment. This also covers preparation of openings in brick wall as per requirement for ducting and piping.
b. Procurement of raw materials, inspection, fabrication, supply, installation and testing of SS304L duct.
c. Identification of all Free Issue Materials (FIM), collection of the same from the premises of departmental stores, handling and cleaning of the same from inside and outside and proper stacking at site of fabrication.
d. Preparation of isometric piping spool drawings after studying piping GA drawings of BARC, and preparation of fabrication drawings for pipe line as per site coordinates after detailed survey, measurement of end co-ordinates for the lines, marking of the dimensions, numbering of weld joints in the isometric spool drawings and getting approval from the Engineer in Charge.
e. Erection & welding of SS304L pipe and duct line as per the approved spool (isometric) drawing. Cutting, edge preparation/beveling, fit-up inclusive of the edges of pipes, fit-ups, cleaning, etc. to match mating edges of uneven/different pipe and duct thickness if applicable are also in part of the contractor.
f. Preparation of detailed QAP for the piping work and getting approved the same prior to fabrication.
g. Preparation of various QA documents (WPS, PQR, WPQ, QAP etc), other test procedures etc for approval of BARC QA.
h. Supply, fabrication, installation, erection, inspection and testing of different sizes of SS304L and carbon steel pipe fittings, flanges, valves etc as per specification and applicable codes & standards.
i. Supply, fabrication, installation and inspection of pipe and duct supports including support items such as clamps, hanger rods, U bolts, anchor bolts & fasteners etc and final alignment of pipes and ducts on these permanent supports.
j. Fabrication and installation of poison plates between MS structure and SS pipes or ducts.
k. Procurement of raw materials, inspection, fabrication, supply, installation and testing of GI duct.
l. Fabrication, supply, installation and testing of isolation manual dampers.
m. Fabrication, supply, installation and testing of air return grills with volume control dampers (VCD), rectangular type.

2. GENERAL REQUIREMENTS:

The work shall be carried out in accordance with the tender & approved fabrication drawings and the documents/codes/standards of issue in effect on the date of the pertinent tender documents as specified in Technical Specifications. In the event of any conflict between any requirement as given in this specification and that of the applicable codes and standards, the governing requirement shall be as per the discretion of the Purchaser.

2.1 DRAWING:

Ducting and piping work is required to be done as per the GA drawings which will be issued by BARC at site of work. The contractor is required to study these drawings, take site measurement and generate the ducting and piping layout drawing form Exhaust room, AWSTF to Enclosure at DF, RSMS. These layout drawings will be approved by BARC's engineers before execution at site.

2.2 APPLICABLE CODES AND STANDARDS:

In particular, the Ducting and piping work shall conform to the following standards:

ASME Section II Part A	:	Ferrous Material Specification
ASME Section II Part C	:	Specifications for Welding Rods, Electrodes and Filler Metals
ASME Section V	:	Nondestructive Examination
ASME Section IX	:	Welding Qualifications
ASTM A 240	:	SS304L plates & sheets
ASTM A 312	:	SS304L Pipes
ASTM A 380	:	Cleaning of Stainless Steel
ASTM - E - 165	:	Liquid Penetrant Examination
IS 277	:	Galvanized Steel Sheets (Plain and Corrugated)
IS 737	:	Wrought Aluminum and Aluminum Alloy Sheet and Strip for General Engineering Purposes
SMACNA	:	HVAC Duct Construction Standards - Metal and Flexible
SMACNA	:	HVAC Air Duct Leakage Test Manual
IS2062 Ed 2011	:	Structural steel
IS800	:	Structural steel design
IS808	:	Structural steel Sections

2.3 MATERIALS:

2.3.1 All materials and components (Other than FIM) like SS sheets, GI sheet, aluminium strips, flanges, gaskets, valves, dampers, structural materials, etc are under the scope of supply of the fabricator and these shall be of genuine quality and relevant standards. The fabrication work shall commence only after obtaining due approval from BARC on the raw material/components procured by the fabricator.

2.3.2 Part of the ducting shall be fabricated from SS304L and part of Galvanised Steel Sheets (GSS). The SS304L ducts are meant for the portion which is outside building. The GI ducts are meant for inside DF building.

2.3.3 GSS shall be of lock-forming grade, zinc coated conforming to IS 277 coating grade 200 gm/m2

2.3.4 All mild steel structural members shall confirm to IS2062 E250 GR BR.

2.4 FABRICATION:

2.4.1 Fabricator shall prepare fabrication drawings, bill of materials, manufacture, inspect, test, pack and deliver at site as per details given in this specification.

2.4.2 Detailed QA plan shall be submitted for approval of the Purchaser prior to start of fabrication.

2.4.3 All supports for duct and piping shall be provided with carbon steel (angle/ channel/ plate/ pipe/ rod/fasteners), machine bolts, nuts in accordance with applicable codes. All anchors shall be designed for rigid fastening to the structures either directly or through a bracket. Pipe and duct shall be supported and fasteners with column support structure.

2.4.4 The structural members shall be fabricated using E6013/6011 electrodes. The size of welds on the structure shall be minimum 6 mm.

2.5 PAINTING:

2.5.1 All support structure shall be given two coats rust inhibiting paint (red oxide) before erection and two coats of final black finish synthetic enamel paint after erection.

2.5.2 All MS surface shall be cleaned painted with two coat of red oxide paint and two coat of synthetic enamel paint.

2.6 DEGREASING AND ACID CLEANING OF SS304L MATERIALS:

All the piping members and other structural members are required to be degreased and cleaned by the approved procedure before installation and erection. The step wise approach of the cleaning methodology is as given under:

a. **Degreasing:** All Stainless Steel pipes and materials shall be degreased prior to acid cleaning using approved detergent in clean water medium.
b. **Cleaning:** All Stainless Steel piping materials shall be thoroughly cleaned by immersing in Nitric Acid as per approved procedure. The material shall be rinsed and cleaned to ensure total removal of all foreign matter like scale, rust, paint, oil, weld spatter, etc. Stainless Steel wire brushes shall be employed for effective scrubbing of the surfaces if needed.
c. **Passivation:** The piping members shall be thoroughly passivated after the cleaning process as above using nitric acid as per approved procedure.
d. **Rinsing:** Piping and other members shall be thoroughly rinsed using clean water to rinse and remove traces of acids on the cleaned and passivated surfaces.
e. **Local Passivation of welds:** Local passivation of welds on SS ducting and SS piping shall be carried out using nitric acid as per instructions of engineer-in-charge at site of work. Thorough rinsing using clean water shall be carried out to remove traces of acids on the locally passivated surfaces.

3. FABRICATION OF STAINLESS STEEL MATERIAL:

3.1 GENERAL:

a. The area in which SS fabrication is being carried out shall be maintained clean for the entire period of fabrication activities.
b. All staff, technicians, supervisors, engineers, etc., deployed for the above work shall be familiar & experienced in handling and fabrication of stainless steel jobs.
c. An exclusive and adequate stock of tools, tackles, consumables, grinding wheels, sandering discs, etc., shall be deployed for the SS job.
d. Stainless steel wire brushes, wire brush wheels, acetone, etc., shall be provided to the welders for proper pass-by-pass cleaning of weld beads.
e. Filler wires shall be kept in clean dispensers and should be stored at dry enclosed area. **All the filler wires shall be cleaned by acetone prior to use.**
f. The stainless steel raw material procured shall be stored under covered, dry and separate area. Suitable measures shall be taken to avoid cross contamination by Carbon Steel and physical damage to SS material.
g. All stainless steel raw materials shall be in clean condition prior to any fabrication (viz., bending, forming, cutting, welding, etc.) activity. Further, all stainless steel material shall be properly cleaned and passivated after any forming process. The cleaning shall comply with approved procedure.
h. All welds on SS piping shall be carried out by providing suitable Argon gas back purging arrangement.
i. All welds on SS ducts shall be carried out by using backing strips.
j. No grinding is permitted adjacent to the weld seam or on the base metal unless found extremely necessary. Any such grinding shall be carried out with concurrence of the Purchaser.

3.2 WELDING:

3.2.1 Welding Procedures & Qualifications Tests

a. Only qualified welders in GTAW welding shall be employed for all welding jobs.
b. Welding procedures shall be qualified on the same grade of stainless steel to be used in actual production.
c. No production welding shall commence until procedure qualification is completed and welders are approved by the QA, NRG, BARC. Fabricator shall submit to the Purchaser copies of the approved procedure and performance qualification reports. All test coupons/specimens shall be properly stamped and retained by the fabricator till completion of work.
d. Cost of conducting all the tests required for qualification shall be borne by the fabricator. Purchaser shall have the right to call further qualification tests from time to time for any welder who is not producing welds of required quality or who has discontinued welding by the particular process for more than three months.
e. Tests for welding procedure & performance qualification shall be carried out in conformity with requirements of ASME Sec IX together with additional requirements included in this specification.

3.3 WELDING REQUIREMENTS:

a. Welding fixtures, clamps or fixtures should not have any surfaces made from lead, zinc or copper/copper alloy that can cause contamination of the stainless steel work-piece. All fixtures shall be lined suitably to avoid any iron contamination of the material.
b. Welding plant, equipment and machinery shall be of good quality and shall be maintained in efficient working condition. The fabricator shall be required to produce documents, if desired, by the Purchaser's Quality Surveyor, in support of proper calibration of the equipment.
c. Fabricator shall ensure that there is a regular and systematic supervision of all welding work. The fabricator shall institute a system whereby all welds can be traced to the welder responsible for their production.
d. Full penetration (FP) pipe welds shall be continuously back purged with High purity Argon gas throughout during welding. The Argon Gas back purging shall be maintained for all the weld passes of the joint. Purging method will be demonstrated by the contractor to QA, BARC.
e. Haphazard striking of electrode/weld torch on base metal or weld material for establishment of arc shall not be permitted. High Frequency unit shall always be used for arc starting. In case inadvertent arc strikes occur, the affected area shall be ground flush and surface examined by dye penetrant test.
f. Necessary precautions shall be taken to avoid distortion.
g. Suitable welding fixtures shall be used in achieving the requisite fit-ups for welding.
h. Due care shall be taken in weld edge preparation by grinding.

3.4 WELDING DOCUMENTATION:

Fabricator shall submit to the Purchaser for his perusal / approval and retention, a complete set of welding records whereby any weld can be traced to the welder responsible for its production, together with the heat/batch number(s) of the electrodes/filler wires used and the welding technique adopted.

4. INSPECTION AND TESTING OF WELDS:

a. The Contractor shall be responsible for and shall provide and perform all the inspection and testing required as per this specification. The contractor shall have a quality assurance set-up along with adequate testing equipment required for LPE and qualified staff to carry out the tests. If any part of the quality assurance work is to be sub-contracted to the outside agencies the same shall be clarified in the offer.
b. The fabricator shall submit a detailed Quality Assurance Plan (QAP) covering all the items and stages of inspection for purchaser's approval. There shall be separate QAP for procurement of each material form. The QAP shall include all sequences and procedures to be followed for achieving the quality required to meet the stipulations of codes and specifications. Clearly identifying witness point, hold point, review point etc.
c. BARC QA or his authorized representative shall have complete access to the work areas of the fabricator and shall have the right to intervene wherever incorrect practices are detected.
d. Weld joints, not meeting the minimum requirements of the applicable specification or code, shall be repaired or replaced at fabricator's expense.

4.1 INSPECTION OF WELDS:

a. The Contractor shall provide all the testing & inspection services, facilities, manpower, except where otherwise specified, for the inspection and testing requirements covered under the scope of this specification.
b. Contractor shall submit all the inspection & testing procedures, WIR, etc and got the same approved through Engineer-In-Charge.
c. Inspection by the Engineer-In-Charge or his authorized representative shall not relieve the contractor of inspection and conformity to this specification.
d. All the material procured by the contractor including welding consumables, liquid penetrant material, etc. shall be of required quality as designated by applicable standards and this specification.
e. All welds shall be LP examined after root and final pass as per ASTM E 165. The LPE material shall be of quality suitable for stainless steel material.
f. Prior to start of welding, inspection procedures shall be established in accordance with the applicable code and this technical specification. Written procedures for each inspection method and technique (including acceptance criteria) shall be submitted to BARC for approval.
g. General requirements and extent of examination:

   i. 100% dye penetrant test on root and finished weld on SS welds.
   ii. Outer surface of the welds shall have smooth and uniform crown. Maximum permitted weld reinforcement on finished weld is +10% of pipe or plate thickness.
   iii. Inside surface of the welds shall be free from oxide formation by providing adequate Argon purging.
   iv. Weld root penetration shall not exceed 0.8 mm for pipe welds.

4.2 VISUAL INSPECTION:

Visual inspection shall be carried out for following:

a. Materials and components to ensure that these are as per the specification and are free from defects.
b. Joint preparation and cleanliness.
c. Fit-up, joint clearance and internal alignment prior to joining.
d. All welds shall be visually inspected by BARC QA after completion.

4.3 DYE PENETRANT EXAMINATION:
(Also called Liquid Penetrant Examination or LPE)

Dye penetrant examination method shall conform to ASME Sec. V and acceptance standards shall conform to ASME Sec. VIII together with requirements specified in succeeding paragraphs. Only visible dye-penetrant solvent (removable type) method shall be employed for all welds, and other metallic surfaces. When used on austenitic stainless steel surfaces, the penetrant materials (penetrant, developer and cleaner), sulphur and total Halogens content shall be less than 1% and 25 ppm respectively.

Following defects/discontinuities as revealed by DP are not acceptable:

a. Lack of Fusion (LOF), lack of penetration, cracks etc.
b. All linear indications.
c. For the weld joints of size 50 mm NB and below no relevant indications of any size are permitted.
d. For sizes above 50 mm NB, single rounded indications more than 0.8 mm diameter on the outside surface or any cluster of indications.

4.4 LOOP PRESSURE TESTING:

a. SS Piping and SS ducting system shall be tested for test loops as approved by BARC.
b. These installed piping systems shall be subject to pneumatic tests to ensure integrity of the erected system.
c. Pressure testing shall be carried out only after the completion of non-destructive testing of welds.
d. Contractor shall provide all isolations, temporary blanking, additional supports testing equipment, calibrated pressure gauges as needed for the job.
e. After satisfactory completion of the leak test, the system shall be gradually de-pressurized.

5. CLEANING AND FLUSHING OF PIPING:

a. During fabrication and installation, the Contractor shall prevent foreign materials such as oil, grease, sand, dirt, scale, loose particles from cutting, grinding, etc from entering the pipe or pipe component. If foreign materials have entered the pipe or pipe component, they shall be removed immediately before the assembly of the parts by a suitable cleaning method such as wire-brushing, blowing through with air or degreasing using a suitable cleaning agent or solvent. Before cleaning with a solvent, the Engineer-In-Charge shall be consulted regarding suitability of the agent especially when alloy or stainless steels are involved. Wire brushes used on stainless steel parts shall be of stainless steel.
b. Cleaning of erected piping systems shall be accomplished by one of the following methods:
    i. All air lines and all lines, which are pneumatically tested, shall be blown with clean dry air.
    ii. Cleaning and flushing operations shall be done through open pipe ends or branches and not through equipment. The cleaning and flushing operations shall be carried out until all trash and construction debris are removed from the piping systems.

6. DUCTING SPECIFICATION

6.1 CONSTRUCTION FEATURES OF G.I. DUCT

Fabrication shall be generally in accordance with the details given hereunder:

Longitudinal seams shall be Pittsburgh lock type at corners. Longitudinal joints shall not be provided for rectangular ducting at locations other than corners, except where larger side of duct exceeds 2500 mm.

The type of transverse joints shall be as follows:

Larger side	**Type of transverse joints**
Upto 300 mm	25 mm wide pocket bar, drive or s-slip
301 to 750 mm	25 mm wide bar slip or pocket slip

Flanges used for transverse joints shall be joined with each other with Galvanised Steel (GS) bolts, washers and nuts. The bolts shall be of minimum M8 size and the spacing between bolts shall be maximum 100 mm.

For transverse angle flanged joints, neoprene gasket (3 mm uncompressed thickness and width equal to flange face) adhered to the flange face shall be used. The bolt holes in gasket shall be the same as bolt diameter and shall be punched prior to insertion of gaskets.

Ducts shall be fabricated using lock-forming machine.

6.2 DUCT SUPPORTS

Duct shall be supported using angles/channel from the structural members of the building. Ducts shall rest on supporting angle or and this supporting angle or channel shall be supported by CS rods or angles or channels on both sides of ducts with weld or bolts. Ducts shall be supported at an interval of 1.5 meters or as suggested by Engineer-in-charge at site of work.

Supporting details for G.I. ducts shall be as given below:

LARGER SIDE OF DUCT mm	BOTTOM SUPPORT ANGLE mm	HANGER ROD DIAMETER mm	STIFFENER SPACING (M.)	STIFFENER SIZE
Up to 450	ISA 40×40×6 or higher	10	Only cross breaking	--

6.3 AIR SUPPLY AND RETURN GRILLS

a. The type and quantity of air return grilles shall be provided as per the specifications. Grilles shall be fabricated from 18G extruded anodized aluminum section with powder coating
b. Whenever VCD is provided with air return grilles it shall be located within the duct collar. All the grilles shall be of flush or stepped pattern.
c. The extruded aluminum air return grills shall be provided with removable central core and concealed key operation for volume control damper.
d. Linear air return grills shall be of 18G extruded aluminum section construction.
e. Supply air grills shall be of double deflector construction type.

6.4 DAMPERS:

Details of damper are given in Annexture-1 of this technical specification. Air leakage through dampers when in the closed position shall not exceed 1% of the maximum design air volume flow rate at the maximum design air total pressure.

6.5 VALVES:

Butterfly valves with wafer type connections shall be provided as per details given in Annexture-2 of this technical specification. Valves shall conform to ISO 10631:2013 for class 150 lbs rating and flanges shall be as per ANSI B 16.5 class 150 lbs rating.

7. DESIGN CHANGE REQUEST (DCR) AND NON-CONFORMITY REPORT (NCR):

In case the job demands for and change during the actual execution of the work due to fouling/ interferences with existing structure or piping , a suitable DCR or NCR (as the case may be) shall be prepared by the contractor for its regularization. The same shall be forwarded to BARC for formal approval. Necessary performa of DCR and NCR shall be provided by BARC as and when needed.

8. DOCUMENTATION:

The fabricator shall compile a Completion Document (in bound form) in respect of piping, ducting, support structures etc. The document shall contain the following information:

a. A material utilization chart giving the each part numbers and designations along with the heat numbers lot numbers of plates, pipes, filler wires etc which have been used in its fabrication. Complete traceability of material heat numbers to each part/component shall be available from the chart.
b. All test certificates relevant to the material used in fabrication of piping & pipe support etc.
c. All test reports for mechanical tests, chemical analysis, contamination check test, mock-up tests, pneumatic tests etc. in respect of materials /pipe/ Box.
d. Approved fabrication drawing.
e. As built drawing for each part/component on paper and soft copy on CD/DVD.
f. Detailed Inspection and QAP
g. Procedure for tests such as DP, Pneumatic test, pickling & passivation etc.
h. Approved copies of WPS, PQR, WPQ, etc as per ASME Section IX requirements.
i. Stage wise inspections carried out by QA, BARC.
j. DCR and NCR issued if any.
k. Scanned copy of compiled documents.

9. SUB-CONTRACTORS/SUB VENDORS:

9.1 Sub-contracting of the entire work shall not be permitted. Bidder shall make clear in his offer the names and full details of the sub-vendors whom they propose to employ for part of the entire work and also specify those parts of the work which are proposed to be sub-contracted.

9.2 The facilities of the sub-vendor/sub-contractor including skilled manpower shall be subject to inspection and approval of the BARC before start of fabrication. Written procedures with regard to the work to be carried out by the sub-vendor/sub-contractor shall be submitted by the contractor to BARC for formal approval.

9.3 However the overall responsibility of completing the job as per this specification lies with the bidder on award of contract.

ANNEXURE-1

Technical specification for Isolation Dampers

1. SCOPE OF WORK:

The scope of the specification cover, procurement of the raw material, manufacture, assembly, inspection, shop testing, packing and safe delivery of Leak tight Isolation dampers at RSMS, BARC, Trombay, Mumbai.

2. APPLICABLE CODES AND STANDARDS:

All the materials used specified & unspecified shall be new and follow relevant BIS or equivalent International codes & standards as indicated below. However, the purchaser's clarification in conflict shall be binding to the supplier.

ANSI N509	Leak Testing of dampers
ANSI N 510	Testing of nuclear air cleaning system
AMCA 500	Testing of dampers
ASME AG1	Nuclear air and gas cleaning system
IS 2062	M.S. Plate structural steel quality
ASME SEC- IX	Welding Qualifications and procedures
ASME SEC- V	Non Destructive Testing
ASTM	Standards for various tests and materials

3. GENERAL REQUIREMENTS

a. All materials used must confirm with the applicable standards & codes listed in these specifications must be new in all respects. All parts shall be free from flaws & objectionable imperfections and shall be machined true in workmanship like manner. Wherever materials are not specified, they shall be properly selected by the contractor to the best standards followed in the industry for the particular applications subject to the approval of the purchaser.

b. The units shall be built to the industry's highest standards of quality to ensure maximum mechanical reliability. All nuts & bolts shall conform to IS-1367, self-tapping screws shall not be used. All welding shall confirm to the requirements of ASME SEC. IX.

c. All the inside and external metal surface of dampers shall be given two coats of epoxy primer and three coats of epoxy painting of approved colour. All the surface shall be thoroughly cleaned & checked, rough edges or weld spatter removed and then cleaned with non-chlorinated solvent and dried before painting.

d. Pair of matching companion flanges with bolts, nuts, gaskets etc. shall be provided for each damper.

4. TECHNICAL REQUIREMENTS

a. The construction of the damper shall be as per ANSI N 509–Class-B and leakage class I. The damper shall be flexible metallic S.S. seal type. The damper shall be provided with good quality SS spring steel sealing element to ensure good air leak-tightness in a moist air stream without replacing the sealing element for longer period of operation.

b. The dampers shall be designed to withstand a minimum pressure differential of 200 mm WG for all types of dampers and other conditions as laid down in the schedule of requirement.

c. The damper shall be totally engineered for ON and OFF operation with Gear operators with complete details of linkages, supports, extension of stem, etc.

d. The damper shall have facility to lock them in totally closed or open position as well as at an angle from 0 to 90 degree in multiples of 10 degree.

e. All the parts not in air stream such as linkages, brackets, linkage connecting rods, unless and otherwise mentioned shall be hot dip galvanized or with hard chrome plating. All fasteners on the damper shall be of stainless steel material.

f. Rubber material used as gasket etc shall be of neoprene and a low shore hardness to give leak tight joint at low bolting down force.

g. Tapings of 8mm with blind plug shall be provided before and after the louver for measuring the pressure drop across the damper.

h. The supplier will give full design details for achieving leak tightness for the operating shaft which comes out of a damper and which operates the louver of the dampers.

5. MATERIAL OF CONSTRUCTION

Body	:	Structural steel sections IS-2062 minimum thickness 6 mm., epoxy painted
Disc	:	Structural steel sections IS-2062 minimum thickness 5 mm., epoxy painted
Sealing element	:	0.5 thick , SS 316 flexible metallic seal
Seating surface / landing bar	:	S.S. 304 L, minimum thickness 8 mm
Shaft	:	20 mm. dia. EN-8
Pressure tapping	:	1/4 inch NPT (F)
Nuts and bolts, screws, studs Washer	:	SS 304
Quadrant plate and operating handle	:	C. S. with hard chrome plating
Stem seal bush, gland packing	:	Teflon (PTFE) filled with suitable material for properties of wear and corrosion resistance and springiness
Shaft bearing	:	Anti friction ball bearing
Companion flanges	:	IS 2062, thickness 8 mm

6. FABRICATION:

a. Frames shall have all welded joints. SMAW welding shall be carried out with proper grade of electrodes. This is to ensure proper integrity, strength and leak tightness. All excess welding shall be evened, ground and finished. All the care should be taken while welding to avoid warping. M.S. to S.S. welding should be done by electrode E 309L.

b. The tolerance for the overall size of the damper shall be +2 mm on outer dimensions and +2 mm for inside dimensions.

c. No fabrication shall be carried out unless the purchaser approves detailed design drawings. All the minor modifications suggested to meet the specification requirements should be carried out with no extra cost.

d. All M.S. surfaces to be painted with approved epoxy paints with 3 coats after 2 coats of enamel primer.

7. GEAR ACTUATORS:

Damper shall be provided with gear for manual operation with proper brackets and shall be of easy removable type. Operators composed of worm and worm wheel type gearing shall be totally enclosed in a gear case and shall have gears of bronze and worms of hardened steel that operate in a lubricant.

8. TECHNICAL DATA SHEET:

Location	Indoor
Fluid flow	Air at max. 45 ^{0}C temperature.
Diff. Pressure	200 mm of W.G.
Air flow direction	Horizontal / vertical
Type of operation	ON / OFF
Louver	Single / multi louvered
Leak tightness	99 %
Mounting	Horizontal / vertical
Shaft	Horizontal
Shaft bearing	Anti friction bearing
Leakage Class Rating	Class-I
Construction Class	B

9. INSPECTION AND TESTING:

9.1 PERFORMANCE TESTING OF ISOLATION DAMPERS:

(i) All the dampers shall be tested at manufactures work along with gear operators for dimensional check up, its operation, leak tightness and adherence to the requirements of the specifications. Dampers shall be tested for leak tightness and other function as per ANSI N 510 and AMCA 500. The supplier shall arrange all the facilities and instrument for the leak tightness testing of the dampers at his workshop.

(ii) Supplier shall prepare QA and inspection and testing procedure for approval before start of manufacture.

(iv) Test for leak tightness through the shaft seal and metallic gasket seat seals shall be done by pneumatic test. The allowable leakage rate shall be 99%. Testing shall be done at 200 mm WG pressure.

(v) All facilities shall be provided by supplier and got approved by purchaser before testing.

9.2 TYPE TEST:

Each and every damper shall be tested for 50 cycles ON /OFF operations to check integrity of sealing element, shaft seal and actuators. It should meet the specification of performance even after cycle test.

10. FABRICATION DRAWINGS:

i. All drawings submitted by the vendor shall be in sufficient detail to indicate the general arrangement with dimensions, bill of materials, components, weight of each unit, packing and shipment, installation plan and any other information specially requested.

ii. After the award of the contract, the vendor shall submit copies material specifications and detailed drawings as called for in the equipment specification for the purchaser's review.

iii. Drawings prepared by the vendor and approved by the purchaser shall be considered as a part of the specification. However examination and approval of the drawings by the purchaser shall not relieve the vendor of his responsibility for engineering, design, workmanship and material under the contract.

11. INSTRUCTION MANUALS :

The vendor shall submit to the purchaser preliminary instruction manuals for all types of dampers before the inspection of equipment. The final instruction manuals complete in all respect shall be submitted by the shipment of the equipment. The instruction manual shall contain detailed diagram, component rating, trouble shooting flow charts, erection procedure, testing procedure, O & M procedures of the equipment.

ANNEXURE-2

Technical specification for butterfly valve

Type of valve	Carbon Steel butterfly valve
Construction	Wafer type
Rating	#150 class
Operation	Manual Lever type
Manufacturing standards	1) As per ISO 10631:2013 2) Outside screw non-rising stem stainless steel valves designed as per ANSI B16.34 3) Leak tightness: Bubble tight shut off for at least 500 cycles of operation between repairs. 4) Trim: Plug -Renewable and Plug form- Solid Wedge 5) Bonnet: Outside screw and yoke
Body	Carbon Steel ASTM A216 Gr WCB
Body liner	Acrylo Nitrile / Black Nitrile / EPDM / Viton / White Nitrile
Disc	SS304/304L/Cast Iron
Seat	PTFE/ Nitrile / EPDM / Viton / Neoprene
Gland packing	PTFE
Stem packing/o-ring	Teflon impregnated asbestos/Viton
Body seal	PTFE + 25% glass
Trims	SS304
Nuts	Nuts: ASTM A-194 Gr. 2H
Bolts	Bolts: ASTM A-193 Gr. B7
Fasteners	SS304
Testing standards	API std 598

ANNEXURE-3

Technical specification for Pedestals

The scope of the work includes:

1. The work shall be carried out as per the scope drawing attached with this technical specification.
2. Earthwork excavation by manual means in all types of soil and soft, removing PCC/RCC, Shahbad stone tiling dressing the sides of foundation, ramming of bottom etc. Including shoring and dewatering (if necessary) and refilling with selected excavated earth in layers of not more than 500mm thick, each layer well rammed and consolidated including disposing the surplus earth with in a distance of 200m all as per drawing and and as directed by the Engineer-in-charge From 0.00 to 1.50 m depth from Average Ground Level

3. Supplying, stacking and laying of 230mm thick rubble soling stones as under floor base including packing with smaller stone and compacting, ramming including spreading and consolidation of blinding material, murrum etc. Complete all as per technical specifications and as directed by the Engineer-in-charge

4. Providing and laying in position cement concrete of 1:3:6 (1 cement,3 crushed sand, 6 graded stone aggregate of maximum size 20mm) including consolidation, finishing, curing etc. Complete as per specifications and drawings but excluding the cost of Formwork shuttering, centering Complete at all levels

5. Providing and laying in position Reinforced Cement Concrete(RCC) of grade M-30 using 20mm maximum size aggregates and crushed sand of approved quality including admixtures of approved brand and quality (plasticiser or super plasticiser) if required, including weigh batching, mechanical mixing, transporting, placing, vibrating, consolidation, finishing, curing etc.

6. Providing Reinforcement Steel for reinforced cement concrete at all levels including supplying, preparation of bar bending schedules, cutting, bending, transporting, fixing, tieing in position with PVC coated G.I binding wire, all labour charges, cost of cover blocks in specified grade of concrete etc. complete as per specifications and drawings

7. Using TMT bars of specified grades of all sizes.TMT bars to be supplied by the contractor from the own plants of SAIL,RINL or TATA make only using virgin materials

8. Providing, centering, shuttering Formwork using steel plates, timber planks for all types of structures including necessary strutting, proping, staging, supports, bracings etc. And deshuttering the same after the specified time all as per drawings , specifications and as directed by the Engineer-in-charge at all levels

9. Technical specification as given in web link http://barc.ernet.in/tenders/TechSpecACED.pdf or http://barc.gov.in/tenders/TechSpecACED.pdf.

ANNEXURE-4

Technical Specification for Carbon Steel structural fabrication work

1. **Scope:**

This specification includes technical requirement of the carbon steel structural fabrication work required to construct the pipe rack between DF and AWSTF facility at RSMS.

The following is the scope of the work:

a. Procurement of complete raw material.
b. Procurement of complete welding consumables.
c. Complete handling at onsite, offsite and transit.
d. Inspection, testing and documentation.
e. Preparation of as built drawings.

2. **SCOPE DRAWINGS:**

Scope drawing of the work shall be issued at the site of work. The work shall be carried out as per the scope drawings. General feature of the pipe rack is as given below:

a. All members are of carbon steel material conforming to IS2062 E250 Gr BR.
b. The pipe rack is supported on civil foundation which is a separate item in the tender.
c. The pipe rack will be at around 4.5 meters height. The contractor shall take all required safety and precautions for the labors employed by them.
d. There is a wall of Brick construction at AWSTF end which will be required to be broken during the work and the same will be restored after the work is completed. This job is also in the scope of the contractor.
e. At the DF end, the MS sheathing shall be cut open to minimum possible size and the same shall be suitably sealed in consultation with Engineer-in-charge. This job is also in the scope of the contractor.

3. **LIST OF APPLICABLE CODES & STANDARDS:**

Following are the applicable codes and standards for the lining work:

Sr. No.	**Code**		**Application**
1	ASME Section VIII Div 1	:	Code of fabrication/construction
2	ASME Section II Part A	:	Ferrous Material Specification
3	ASME Section II Part C	:	Specifications for Welding Rods, Electrodes, and Filler Metals
4	ASME Section IX	:	Welding Qualifications
	ASME Section I Div 8		Liq. Penetrant Testing of welds
5	IS2062	:	Carbon Steel Plates (E250 GR BR

4. **RAW MATERIALS:**

Contractor should note that no free issue material (FIM) has been envisaged for the above work except those listed in Schedule B of the tender. The Contractor shall arrange entire materials for the completion of the work including electrodes for the construction of shielding.

5. **WELDING PROCESS:**

a. Complete welding within carbon steel plates shall be by SMAW.

b. The bevel edges of the joints shall be prepared by grinding or gas cutting. In case gas cutting is employed for the job, the edges shall be properly ground to remove oxides and slag.
c. The edges shall be properly finished for mating parts.
d. Electrode type used shall be SFA 5.1 E6011 or E6013.

6. FABRICATION REQUIREMENTS:

a. The job involves heavy structural steel works. The handling should be done carefully.
b. Dimensional tolerances shall be maintained as per drawing. In case the dimensional tolerance is not mentioned, IS 2102 Medium will be followed in consultation with Engineer-In-Charge.
c. Straightness and flatness of the fabricated structure shall be maintained.

7. INSPECTION OF ERECTED STRUCTURE:

a. **Visual inspection:** The surfaces shall have good finish.
b. **Dimensional inspection:** The fabricated shielding surfaces shall be so welded that the specified dimensional tolerances are maintained.

8. PAINTING:

a. Painting shall be done only after complete removal of foreign substances (oil, paint etc) on surface by suitable methods.
b. All the outside surfaces shall be painted with one 2 coats of red oxide paint as per the instructions mentioned in the instruction manual of the paint manufacturer.
c. After drying of the primer coat, the outer surfaces shall be painted with 2 coats of synthetic enamel paint of approved brand as per the instructions mentioned in the instruction manual of the paint manufacturer.

9. GUARANTEE: The job shall be guaranteed for a period of 12 months from the date of its acceptance for material and workmanship.

10. DOCUMENTATION: Following shall form part of documentation:

a. As built drawings
b. Material Test certificates.

SCHEDULE –A

List of Free issue material (FIM) will be provided by BARC for this work:

Sr. No.	Name of Item	Quantity
1	Pipe SS 304L 150 NB Sch. 10	75 meter
2	SS308L Filler wire 1.6 mm dia	10 kgs
3	SS308L Filler wire 2.5 mm dia	10 kgs

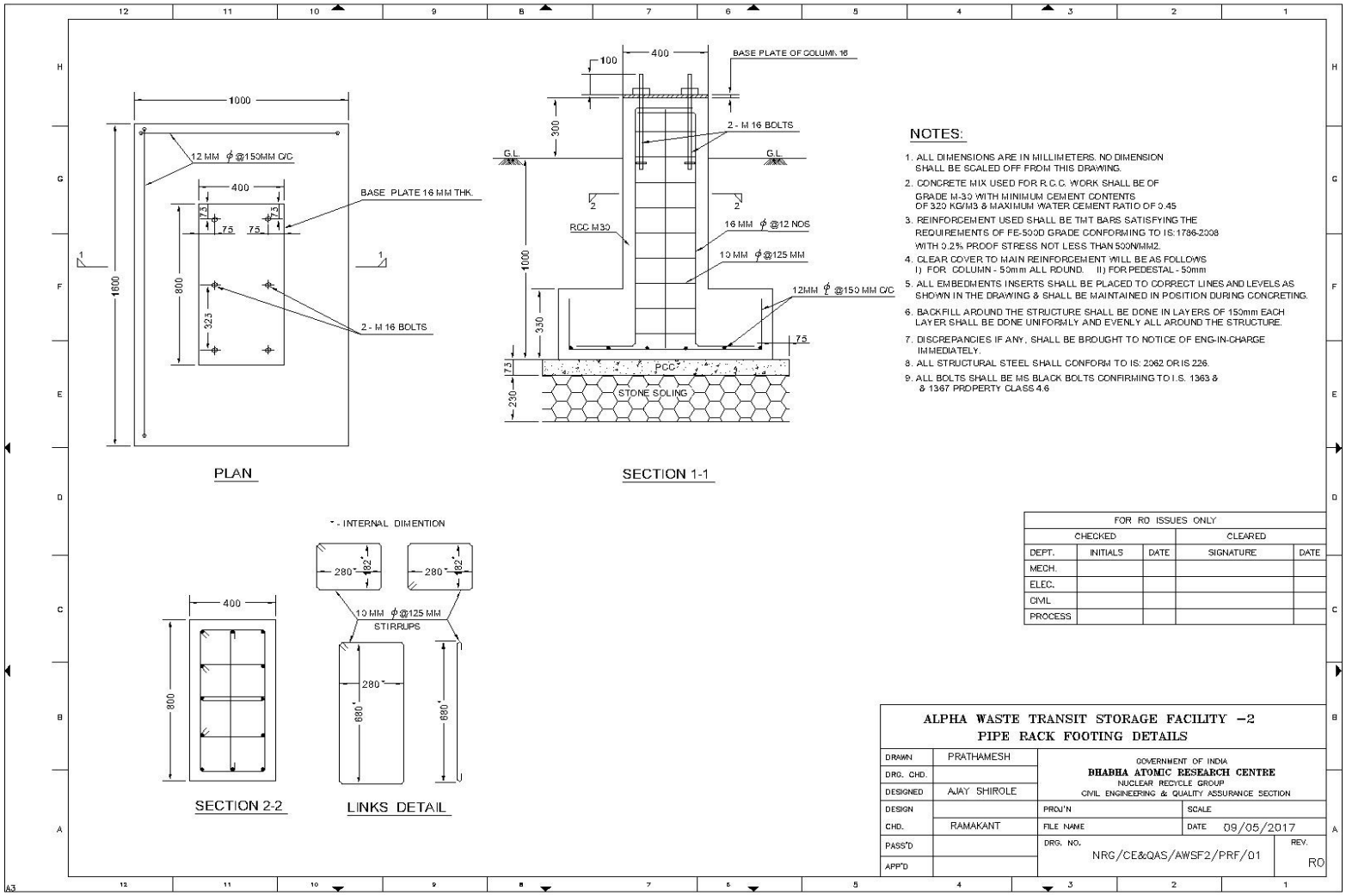
SCHEDULE – B

Bill of Quantity (BOQ): The bill of quantity is shown below. The minor quantity or scope may change at any stage. However the supplier/ vendor have to complete the revised/ change work without any extra cost.

Sr. No.	Description of work	Unit	Quantity
1.	Procurement of complete raw material, inspection, testing, installation, erection of Carbon Steel Structural members using SMAW process at height up to 6 meters along with 2 coats of synthetic enamel paint after applying primer coat.	kg	5000
2.	Fabrication, inspection and testing of Pedestals as per technical specifications and scope drawing.	Number	6
3.	Procurement of complete raw material, fabrication, welding, inspection, testing and erection of 3 mm thick SS ducts with DPT as requirement for root and final weld layers and fabrication of SS structural supports etc. The job also involves the breaking of the wall/metal sheeting and restoring of the same after passing the ducts.	kg	1100
4	Procurement of complete raw material, fabrication, inspection, testing and erection of Galvanized steel ducts in 20 Gauge thick sheets.	sq. m	45
5	Procurement of complete raw material, fabrication, inspection, testing and erection of Volume Control Damper with Grill in powder coated Aluminum material and size of 100 mm x200 mm	Number	5
6	Procurement of complete raw material, fabrication, inspection, testing and erection of Volume Control Damper with Grill in powder coated Aluminum material and size of 300 mm x300 mm	Number	1
7	Procurement of complete raw material, fabrication, inspection, testing and erection of Manual Isolation damper with min. 99% sealing efficiency and size of (550 mm x550 mm)	Number	1
8	Procurement of complete raw material, fabrication, inspection, testing and erection of Manual Isolation damper with min. 99% sealing efficiency and size of (300 mm x300 mm)	Number	2

Sr. No.	Description of work		Unit	Quantity
9	Erection of SS304L Piping in various sizes up to 200 NB size[Job involves study of piping GA drawing, identification of nozzles, taking site measurements, preparation & approval of pipe spool drawings, identification of all materials, taking delivery of the FIM from departmental stores, complete handling, transportation, detergent washing, pickling & passivation as per need, rinsing, marking, cutting of pipes, edge preparation, fit-up, tack welding, alignment, complete erection, testing etc and readying the same for GTAW welding as per approved spool drawings]		Inch-meter	350
10	Butt welding of stainless steel pipes & pipe fittings by GTAW process using high purity Argon gas (99.995% min) for shielding & back purging, Liquid Penetrant Examination		Inch-dia	330
11	Butt welding of Carbon Steel pipes & pipe fittings by SMAW process using high E6013 electrodes and Liquid Penetrant Examination		Inch-dia	20
12	Procurement, inspection, testing, installation and erection of Carbon Steel valves including nuts, bolts, washers etc and also providing neoprene gaskets, complete handling etc as per technical specification and scope drawing and in following sizes:			
	12.1	Wafer type Butterfly valve Class 150 Size in 150 NB size	Number	4
	12.2	Wafer type Butterfly valve Class 150 Size in 200 NB size	Number	1
13	Procurement, inspection, testing, installation and erection of flanges (without site welding) in following sizes as per technical specification and scope drawings:			
	13.1	SS304L Class 150 SORF 25 NB With SS bolts, SS nuts and SS washers	Number	20
	13.2	SS304L Class 150 SORF 150 NB With SS bolts, SS nuts and SS washers	Number	8
	13.3	Carbon Steel Class 150 SORF 200 NB with SS bolts, SS nuts and SS washers	Number	2
14.	Procurement, inspection, testing, installation and erection of Stainless Steel 150 NB Sch 10 elbow (without welding) as per technical specification and scope drawings:		Number	15
15	"Providing and placing at site MS foundation bolt of required size, shape and length as per IS:5624, of mechanical property class - 4.6 as per IS:1367-Part-3, with two numbers of compatible hexagon nuts (conforming to IS:1363), washers with each bolt of reputed make, fixing at site complete as per drawing and technical specifications." (a) Anchor Bolt size M10/12, length 125 mm		Number	50

Reference Enquiry no.: Ref.: BARC/NRG/TDD/DF/P&V/2017/75548 Dt: 05/05/2017



FOR RO ISSUES ONLY				
CHECKED			CLEARED	
DEPT.	INITIALS	DATE	SIGNATURE	DATE
MECH.				
ELEC.				
CIVIL				
PROCESS				

ALPHA WASTE TRANSIT STORAGE FACILITY –2
PIPE RACK FOOTING DETAILS

DRAWN	PRATHAMESH	GOVERNMENT OF INDIA **BHABHA ATOMIC RESEARCH CENTRE** NUCLEAR RECYCLE GROUP CIVIL ENGINEERING & QUALITY ASSURANCE SECTION	
DRG. CHD.			
DESIGNED	AJAY SHIROLE		
DESIGN		PROJ'N	SCALE
CHD.	RAMAKANT	FILE NAME	DATE 09/05/2017
PASS'D		DRG. NO. NRG/CE&QAS/AWSF2/PRF/01	REV. RO
APP'D			