DELHI AVIATION FUEL FACILITY PRIVATE LIMITED
AVIATION FUELLING STATION
SHAHBHAD MOHAMMADPUR
IGI AIRPORT
NEW DELHI-110061

TENDER NO: DAFFPL/MOD/FHS/2018-19/23

TENDER FOR AVIATION FUEL HYDRANT SYSTEM WORKS at IGI AIRPORT CARGO TERMINAL

BID DUE DATE & TIME: 1500 Hrs. IST on 25th March 2019

OPENING OF TECHNICAL BIDS: 1100 Hrs. IST on 26th March 2019

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Sign & Stamp of Bidder

Contents

NOTE: BIDDERS ARE REQUESTED TO SIGN AND STAMP ALL THE PAGES OF THE TENDER DOCUMENT AND SEND THE SAME BACK IN THEIR OFFER AS A TOKEN OF UNCONDITIONAL ACCEPTANCE OF TENDER FIRMS.

THE DEVIATIONS, IF ANY, SHOULD BE MENTIONED SEPARATELY ON BIDDER"S LETTER HEAD IN TECHNICAL BID. THE DEVIATIONS MENTIONED ANYWHERE ELSE SHALL NOT BE CONSIDERED. IN ABSENCE OF DEVIATION SHEET IT WOULD BE CONCLUDED THAT BIDDER HAS ACCEPTED THE TENDER TERMS WITHOUT ANY DEVIATIONS. CORRECTIONS IN TENDER DOCUMENT WILL NOT BE ACCEPTED.

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Sign & Stamp of Bidder

DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

TENDER NOTICE
DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

INVITING BIDS FOR AVIATION FUEL HYDRANT SYSTEM WORKS at CARGO TERMINAL

TENDER NO: DAFFPL/MOD/FHS/2018-19/23

Delhi Aviation Fuel Facility (P) Ltd (DAFFPL) invites sealed bids under single stage two bid system from eligible bidders for Cargo Terminal Aviation Fuel Hydrant System Works and other related works as per specification as required.

Bid Security (EMD):	As mentioned in the Tender document
Date, Time & Venue for Voluntary Pre-bid Meeting:	14th March 2019; 11:00 HRS (IST) at DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur, New Delhi-110061
Bid Due Date, Time & Place of Submission:	Upto 15:00 HRS (IST) on 25th March 2019 at the office of the Chief Executive Officer, DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur.
Office Working Days & Time	Monday to Friday – 09:30 AM to 18:00 PM Saturday – 09:30 AM to 13:30 PM

Detailed Invitation for Bids (IFB) along with Pre-qualification Criteria, Bid Document Corrigenda can be viewed and downloaded from DAFFPL's website: **http://www.daffpl.in**

Chief Executive Officer
DAFFPL, New Delhi
9810081078

Sign & Stamp of Bidder

CHAPTER 1: INTRODUCTION (COVERING NOTE)

Delhi Aviation Fuel Facility Private Limited (DAFFPL) is a Joint Venture comprising Indian Oil Corporation Ltd. (IOCL), Bharat Petroleum Corporation Ltd. (BPCL), and Delhi International Airport (P.) Ltd. (DIAL). We provide the infrastructure aimed at ensuring an uninterrupted flow of Aviation Turbine Fuel (ATF) to all type of aircrafts at the Indira Gandhi International Airport, New Delhi (IGI Airport) as per international benchmarking.

We are pleased to invite your most competitive offer for "CARGO TERMINAL AVIATION FUEL HYDRANTSYSTEM WORKS" in complete accordance with the tender documents attached herewith.

Tender document is available on our website. The bid documents can also be collected from our office and the bids are to be submitted in Physical form in the Tender Box kept at the office of the **Delhi Aviation Fuel Facility Private Limited (DAFFPL)** at Shahabad Mohammadpur, New Delhi-110061, India.

1. The Tender is floated in Two Bid system consisting of Technical Bids (Bid Qualification Criteria - BQC, Technical plus Commercial) and Price Bids.

   Part-I : Bid Security / EMD in accordance with tender document.
   Part-II : BQC (Bid qualification criteria), Technical & commercial Bid, duly filled in & along with all supporting as requested to be submitted in Physical form in the Tender Box.
   Part –III : Price Bid.

2. Firstly, the Technical bid (BQC & Techno commercial bids) shall be opened. The Bids shall be initially scrutinized as per tender requirements of BQC (Bid qualification criteria). Technical cum commercial bids of only those bidders who qualify the BQC will be processed further. The price bids of only techno-commercially qualified bidders will be opened, evaluated and shortlisted for placement of Order.

3. Each page of bid documents is to be duly signed & stamped by the bidder before submitting the Tender.

4. The bids submitted should be valid for **four months** from the due date of bid submission for Owners acceptance. Once accepted it will remain firm till completion of contracts/orders.

5. We request the bidder to carefully go through all tender documents before submitting the offer. Please note that any exceptions or deviations to the tender document are necessarily to be recorded in the attached deviation statement only. Any exceptions/deviations brought out elsewhere in the bid shall not be considered.

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6. The bidders to provide their bank details/ PAN / GST Registration numbers, as applicable for updating bidder master file. You are also requested to keep us informed of any change in address / status of your business / contact details including email address etc.

7. Party can quote with the deviations as referred in Point No.6 above. Please refer query end date / time in tender calendar after which no query posted by bidder shall be considered. However, DAFFPL reserves the right to respond the queries after cutoff date / time mentioned in tender calendar.

8. Please note that queries related to scope of job, terms & conditions etc., should be submitted by means of letter/E mail to reach the owner's office not later than one week before the meeting .It may not be practicable to answer queries received late, but queries and responses/clarifications will be posted in the form letter, E-mail within one week from the date of Pre Bid Meeting. Any modification in the bid document that may become necessary as a result of the Pre Bid meeting shall be made by the owner exclusively through the issues of corrigendum/ addendum posted at web site and not through the minutes of the pre bid meeting.

9. UNSOLICITED POST BID MODIFICATION
   Bidders are advised to quote strictly as per terms and conditions of the Bidding Document. After tender submission due date & time/extended due date & time (as the case may be) the bidders shall not make any subsequent price changes, whether resulting or arising out of any technical / commercial clarifications sought/allowed on any deviations or exceptions mentioned in the bid unless discussed and agreed by DAFFPL in writing.

10. EMD & Techno Commercial bid shall be opened on **26th March 2019 at 11:00 Hrs (IST)** in the presence of authorized representative of bidders (Restricted to one [1] person per bidder only) at the office of DAFFPL. Price Bid of only those bidders whose offer is found meeting both PQC & techno-commercially acceptable, shall be opened on a later date as per convenience of DAFFPL after intimation to the qualified bidders.

11. DAFFPL reserves the right to accept any tender in whole or in part or reject any or all tenders without assigning any reason. DAFFPL reserves right to accept any or more tenders in part. Decision of DAFFPL in this regard shall be final and binding on the bidder.

QUERIES AND CLARIFICATIONS: Any query or clarification with regard to this tender may please be referred to below address & phone nos. on any working day during office working hours

M Vishnu Vardhan Assistant Manager - Projects Vishnu.vardhan@daffpl.in, rakesh.arora@daffpl.in 8826000228	Manish Kumar Project Officer manish.kumar@daffpl.in 9810640818

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12. GOVERNING LAWS: The laws of Union of India shall govern all matters concerning the tender. Any issue arising related to the tender or the selection process shall be adjudged by the courts in Delhi alone.

13. A Pre-bid meeting is scheduled for **14th March 2019 @ 11:00 Hrs IST** at the office of DAFFPL, New Delhi. All prospective bidders can participate in the same. Any clarification with regard to tender shall be sorted out during the pre-bid meeting.
    a. The purpose of the pre-bid meeting is to clarify any doubts of the BIDDER on the interpretation of the provisions of tender.
    b. Bidder(s) are requested to submit their queries, mentioning form name, clause no. & clause, by a letter / e-mail to our office as per schedule in order to have fruitful discussions during the meeting.
    c. All the Bidder(s) are requested to attend the pre-bid meeting to be held at DAFFPL Office as per schedule.

14. Tender document can be purchased from our office located at Shahabad Mohammadpur at a cost of Rs 5000/- and also can be downloaded from our website www.daffpl.in.

    - **A bidder who downloads the document from website must submit a separate DD for an amount of Rs.5000/- along with the EMD document.**
    - **Bidders who purchase the document from our office must submit a DD for an amount of Rs.5000/- at the time of purchase.**
    - The demand Draft should be drawn in favor of **M/s. Delhi Aviation Fuel Facility Pvt. Ltd.** payable at **New Delhi**

15. **Earnest Money Deposit (EMD) (also referred to as Bid Security):** Bidder shall be required to submit the Earnest Money Deposit (EMD), either in the form of Bank guarantee as per format (provided as Annexure) or PAY ORDER or BANK DRAFT (in favour of Delhi Aviation Fuel Facility Private Limited, payable at New Delhi) at our office. The EMD in either form has to be submitted on or before the due date & due time of bid submission of this tender with a covering note mentioning the tender no.
    a. The bidders not submitting EMD by due time & date shall be rejected & their bids shall not be evaluated further.
    b. **The EMD amount shall be 100,000.00 INR**
    c. Firms registered with National Small scale Industries (NSIC)/MSME of India are exempted from submission of bid security. Central Public Sector Enterprises of India and Firms registered with Nation Small Scale Industries Corporation (NSIC) of India are exempted from submission of Bid Security. Central Public Sector Enterprises are requested to give a self-declaration on their letter head to this effect. Bidders registered with NSIC of India are also requested to submit self-declaration on their letter head to this effect along with a copy of their Valid Registration certificate, specifying limit of volume and other details which should be submitted.

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CHAPTER 2: INSTRUCTIONS TO BIDDERS

1. The bidder shall bear all costs associated with the preparation and submission of the bid and Owner will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

2.
- Bidder is requested to submit their bids taking full notice of all the scope of work, terms and conditions, forms & attachments to this tender. Bids must be submitted in Physical form only.
- The authorized Indian representatives of foreign firm while submitting their offer shall ensure that the bids are submitted strictly as per the rules. Bids in Foreign Currency will not be accepted. If successful, order will be on Indian representative only. EMD shall also be submitted in Indian currency as per Clause mentioned above.

3. Owner is not responsible for any delays from bidder end.

4. Owner reserves the right to make any changes in terms and conditions of tender before due date of bid submission and to reject any or all bids received incomplete.

5. Undertaking by the bidder:
   a. I/we hereby undertake that the statements made herein/information given in the bids through Physical Tendering system/annexure/forms referred are true in all respects and that in the event of any such statement or information being found to be incorrect in any, the same may be construed to be a misrepresentation entitling DAFFPL to avoid any resultant contract.
   b. I/we further undertake as and when called upon by DAFFPL to produce, for its inspection, original(s) of the document(s) of which copies have been annexed hereto.

6. Owner, at its discretion reserves the right to verify information submitted by the bidders.

7. Bidder to submit documents/information to satisfy the bid qualification criteria. Bidders should also be in a position to produce further information as and when required by DAFFPL with in a time limit of 15 days.

8. DAFFPL reserves their right to negotiate the quoted prices with lowest bidder.

9. Bidders would be qualified based on data and documents submitted by them.

10. Owner's decision on any matter regarding short listing of bidders shall be final and no corresponding in this regards will be entertained.

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11. The bidders who are on IOCL/BPCL/DIAL holiday list or delisted will not be considered.

12. The bidder is expected to examine all instructions, forms, attachments, terms and specifications in the tender document. The entire tender document together with all its attachments thereto, shall be considered to be read, understood and accepted by the bidder, unless deviations are specifically stated seriatim by the bidder. Failure to furnish all information required in the tender document or submission of a bid not substantially responsive to the tender documents in every respect will be at bidder risk and may result in the rejection of his bid. The bidder scope of supplies as specified in the material requisition shall be in strict compliance with the scope detailed therein and in the bid document.

13. Bidders in their own interest shall ensure that they submit their bid, complete in all respects, well within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.

14. At any time prior to the bid due date, we may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bid document. The amendment will be notified through our portal www.daffpl.in to all prospective bidders and will be binding on them. In order to afford prospective bidder, reasonable time in which to take the amendment into account in preparing their bids, we may, at our discretion, extend the bid due date.

15. The bid prepared by the bidder and all correspondence/ drawings and documents relating to the bid exchanged by bidder and the owner shall be written in ENGLISH language, provided that any printed literature furnished by the bidder may be written in another language so long as accompanied by an ENGLISH translation, in which case, for the purpose of interpretation of the bid, the ENGLISH translation shall govern.

16. Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or Public Sector Undertaking (PSU) as per declaration format (provided as annexure) of the tender document should be submitted along with the bid.

17. Bidders are advised to submit bids based strictly on the terms & conditions and specifications contained in the tender document and not to stipulate any deviations. Each Bidder shall submit only one bid. A Bidder who submits more than one bid will be rejected. Alternative bids will not be accepted.

18. The Owner may, at its discretion, extend the bid due date, in which case all rights and obligations of the Owner and the Bidders, previously subject to the bid due

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date, shall thereafter be subject to the new bid due date as extended. The same will be hosted in the web site.

19. Bids shall be kept valid for 4 months from the bid due date. A bid valid for a shorter period shall be considered as non-responsive and rejected by the Owner. Notwithstanding above, the Owner may solicit the Bidder consent to an extension of the period of bid validity. The request and the responses thereto shall be made in writing. The EMD (bid security) shall also be accordingly extended.

20. Telex/ Telegraphic/ Telefax / E-mail offers will not be considered and shall be rejected.

21. No bid shall be modified subsequent to the due date & time or extension, if any, for submission of bids. Bidder(s) to note that Price changes after submission of bid shall not be allowed. In case any bidder gives revised prices/price implication, his bid shall be rejected. No bid shall be allowed to be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder. Withdrawal of a bid during this interval shall result in the forfeiture of Bidder s EMD.

22. Bids that do not meet the Bid qualification criteria as specified in the bid document shall be rejected. A bid with incomplete scope of work and/or which does not meet the technical requirements as specified in the bid document, shall be considered as non-responsive and rejected. Conditional bids will be liable for rejection.

23. The Owner will examine the bids to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.

24. The bids without requisite EMD and/or not in the prescribed Performa and the time limit will not be considered and bids of such bidder Bidder(s) shall be rejected.

25. PRICE EVALUATION CRITERIA: As award is on overall landed lowest basis, part offers will be rejected. Bidder has to quote for all items in a lot for us to consider them.

26. Prior to the expiration of period of bid validity, the owner will notify the successful bidder in writing or by e-mail, that his bid has been accepted.

27. Any efforts by a bidder to influence the owner/ in the owner bid evaluation, bid comparison or contract award decisions may result in the rejection of their bid.

28. ISSUE OF CONTRACT: After the successful bidder has been notified that his bid has been accepted, DAFFPL will send to such bidder a detailed contract order

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incorporating all the terms and conditions agreed between the parties. Within 15 days of receipt of the detailed order, the bidder shall sign and return to the owner the duplicate copy of the order as a token of their acknowledgement.

29. Vigil Mechanism: DAFFPL has developed the Vigil Mechanism to deal with references/ grievances, if any, that is received from bidders who participated / intends to participate in the tender. The details of the same are available on our website www.daffpl.in

30. VERIFICATION BY OWNER: All statements submitted by bidder regarding experience, manpower availability, equipment and machinery availability etc., are subject to verification by the owner either before placement of order or after placement of order. If any data submitted by the bidder at the bid stage is found to be incorrect, the offer is liable to be rejected or the contract/order is liable to be terminated.

31. SEALING & MARKING OF BIDS

A. Bids shall be submitted separately in THREE SECTIONS in sealed envelopes superscribed with the Bid Document number, bid due date and time, item and nature of bid as under:

- **SECTION - I (Envelope No. 1): Bid Security / EMD:**
  Bid security in accordance with tender document.

- **SECTION - II (Envelope No. 2): Technical Bid:**
  a. Information and documentary evidence establishing bidders claim for meeting qualification criteria. This section/envelope should necessarily contain all the required back-up documents for Bid Qualification.
  b. Technical bid complete with all technical and commercial details, covering letter. **Deviation sheet duly filled with deviations, if any, shall form part of technical bid.**

- **SECTION - III (Envelope No. 3): Price Bid:**

  a. PRICE BID WITH FULL PRICE DETAILS. The price bid shall contain prices only without any technical and commercial details. Technical specifications or commercial terms given in unpriced schedule will only be evaluated and the same will be binding on the Bidder. The bids shall be sealed and kept in a single envelope with marking as Section - III (Price Bid) / Envelope No. 3: "Original'
  b. The bidder shall quote the final prices (excluding taxes, Cess, duties and other levies etc) in the 'PRICE SCHEDULE FORMAT' of bid

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document ONLY.

c. The Price bid shall be kept in a larger envelope duly sealed and shall bear the name and address of the bidder.

B. The envelopes containing Section -I, Section -II, Section -III of bid shall be enclosed in a larger envelope duly sealed and pasted and shall bear the name and address of the bidder.

C. Bidder to note that if bid security / EMD (in the Proforma attached with these documents) in original and/or bid document fee (if the bid document is downloaded) is kept in any other envelope and not found in envelope no. 1, the offer of the bidder(s) will be REJECTED during opening.

D. Price bids received in open condition (not in sealed envelope) or kept in any other Section of the bid (i. e, Section - I or II) will also be liable for rejection.

E. If the outer envelope is not sealed and not marked as required, then DAFFPL will assume no responsibility for the bid's misplacement or premature opening.

F. Bidders in their own interest shall ensure that they send their bid complete in all respects well in time to reach the specified office within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.

G. Central Public Sector Enterprises and Firms registered with NSIC are exempted from submission of Bid Security. Central Public Sector Enterprises are requested to give a self-declaration on their letter head to this effect, which should be submitted in a sealed envelope marked as Bid Security.

H. Bidders registered with NSIC are also requested to submit self-declaration on their letter head to this effect along with a copy of their Valid Registration certificate, specifying limit of volume and other details which should be submitted in a separate sealed envelope no. 1 marked as Bid security.

I. Bid Security strictly in the Proforma attached with these documents shall be submitted in Original along with the Bid. Bids received without original bid security, shall not be opened for evaluation.

J. Tender document complete in all respects must be submitted in the tender box provided at the DAFFPL office before due date and time

32. DOCUMENTS COMPRISING THE BIDS

The bid prepared by the Bidder shall comprise the following components:

I. **ORIGINAL BID SECURITY (Section - I):** Bidders are advised to instruct their banks not to post Bid Security directly to Owner as the same has to accompany with the bid.

II. **TECHNICAL BID (Section -II):**

- Documentary evidence establishing Bidder's claim for meeting

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qualification criteria as stipulated in the Bid Document.

- Notarized Audited Annual Report of previous three financial years.
- Documentary evidence establishing Bidder's eligibility to bid and that the offered Goods conform to the Bid Document.
- Price Schedule (with Price figures blanked) completed in accordance with the requirements specified in the bid document.
- Agreed Terms & Conditions duly filled-in.
- Deviation Sheet, if any.
- Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or PSU's.
- Any other information/details/documents/data required as per Bid Document.
- Parent Company Guarantee, if applicable

III. **PRICE BID (Section -III):** Bid Form and Price Schedule duly filled in.

33. BID FORM & PRICE SCHEDULE

The bidders shall complete the Bid Form and appropriate Price schedule, indicating the required information for all quoted items.

34. FORMAT AND SIGNING OF BID

a. The bid shall be typed or written in indelible ink and shall be signed by the bidder or a person or persons duly authorized to sign on behalf of the bidder on all pages of the bid. Such authorization shall be indicated by written Power of Attorney accompanying the bid. The name and position held by each person signing must be typed or printed below the signature. The person or persons signing the bid shall initial all pages of the bid, except for unamended printed literature.

b. The complete bid shall be without alterations, interlineations or erasures, except as may be necessary to correct errors made by the Bidder, in which case such corrections shall be rewritten & initialed by the person or persons signing the bid.

c. All the pages of the price bid shall be signed by the authorized signatory. In case all the pages of the price bid are not signed, the bid shall be rejected.

35. OPENING OF BIDS

Bids will be opened by Owner at DAFFPL Office, New Delhi, in the presence of bidders/bidders authorized representatives available on the opening date and time (duly authorized by a competent person and having the letter of authority).

a. **BID SECURITY / EMD (SECTION-I) AND TECHNICAL BID (SECTION-II):**

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I. On the day and time of bid opening, Bid security (Envelope 1) and Technical Bid (Envelope 2) shall be opened in presence of bidders.
II. The Bidder's representatives, who are present, shall sign a register/attendance sheet evidencing their attendance.
III. The Bidder(s) names, presence or absence of requisite bid security will be announced at the opening.

b. **PRICE BID OPENING (SECTION -III):**
I. Only those bidders whose bids meet the qualification criteria and are technically/commercially acceptable shall be called for opening of Price bid (Envelope 3) at a later date, informed in advance.
II. The Bidder's representatives, who are present, shall sign a register/ attendance sheet evidencing their attendance.

36. EVALUATION OF BIDS

a. Qualification of Bidder: The experience details and financial & technical capabilities of the bidder(s) shall be examined to determine whether the bidder(s) meet the Bid Qualification Criteria mentioned in the INVITATION FOR BIDS (IFB).
b. The Owner will examine the bids to determine whether they are complete, any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.
c. The bids without requisite Bid Security and/or not in the prescribed proforma will not be considered and bids of such bidder Bidder(s) shall be rejected.
d. To assist in the examination, evaluation and comparison of technical bids, the owner/ may, at its discretion, ask the Bidder clarifications on the bid. The request for such clarifications and the response thereto shall be in writing.
e. Prior to the evaluation and comparison of the bid, the owner will determine the substantial responsiveness of each bid to the bidding documents. For the purpose of this Article, a substantially responsive bid is one, which conforms to all the terms and conditions of the bidding document without material deviations or reservations. A material deviation or reservation is one which affects in any substantial way the scope, quality, or performance of the works or which limits in any substantial way, inconsistent with the bidding document, the DAFFPL's rights or Bidder's obligation under the contract and retention of which deviation or reservation would affect unfairly the competitive position of other bidders presenting substantially responsive bids. The owner's determination of bid responsiveness is to be based on the contents of the bid itself without recourse to the extrinsic evidence.
f. A bid determined as substantially non-responsive will be rejected by the

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Owner and shall not subsequently be allowed by the Owner to be made responsive by the Bidder by correction of the non-conformity.

37. **Execution of works:**

The successful bidder shall submit on receipt of the work order and before starting the work, shall submit a detailed construction programme (PERT/ MS PROJECT) chart adhering to the completion time quoted in the work order. The program thus submitted shall form a part of the contract and shall be binding on the Successful Bidder. However, the company reserves the right to alter the programme if necessary. No claim whatsoever of the Successful Bidder on this account will be entertained.

38. **Materials/ Equipment's:**

All materials required for execution of work must be got approved by our site representative before they are brought to the site and also before being actually put to use. All facilities for prior inspection of materials and subsequent inspection of work by our site engineer must be made available.

39. **Materials without approval:**

i. Any material brought without prior approval will be entirely at the risk and cost of the Successful Bidder.

ii. If Successful Bidder brings defective/ sub-standard materials to site, it shall be the responsibility of the Successful Bidder for the removal and disposal of the same at his cost. The company shall not entertain any claim from the Successful Bidder in this account in case the Successful Bidder fails to remove such materials within 15 days after issuing notice in writing to the Successful Bidder. Company reserves the right to dispose such materials at the entire risk and cost of the Successful Bidder.

iii. Work order quantities are approximate, and payment shall be made as per actual measurements. The Successful Bidder is not entitled to for any sort of compensation towards materials procured/ stored in excess of the measured quantity if any.

iv. Excess quantities over and above that mentioned in the work order or extra items or deviation in work order should not be carried out by the Successful Bidder unless he has been asked to do so in writing and if carried out without such written approval, the same will be at risk and cost of the Successful Bidder.

v. Detailed measurement of works carried out shall be jointly taken by the Successful Bidder and our site engineer at every stage of work before proceeding to the next stage.

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vi. Entire works shall be carried out under the supervision of the authorized representative of the company.

40. **Procurement of materials:**
It shall be Successful Bidder's responsibility for procurement of all materials/ equipment etc and no delay due to non- availability of any materials/ equipment's will be entertained by the company.

41. **Safety and security of materials:**
The responsibility of the materials and equipment brought or installed by the Successful Bidders (till they are handed over to us) will remain with the Successful Bidder and any claim of whatsoever nature due to any loss or otherwise will not be entertained. The Successful Bidder will have to handover completed job in its entirety as per work order.

42. **Method of work:**
The Successful Bidder shall carry out works as per directions in the work order. The Successful Bidder shall not undertake on his own any change in the specifications mentioned in the tender documents and work order. In case of doubt, the Successful Bidder will refer the matter in writing and the Successful Bidder shall carry out the item of work as per clarifications given. In case of delay in getting such clarifications, the Successful Bidder will not be entitled for any claim on any account of idling of their labourers, machinery etc. In case the Successful Bidder carries out the work as per his own specifications not acceptable to the company in such cases, the same will be required to be redone as per the specifications given by the company at the Successful Bidder's risk and cost. In case of failure to re-do the work by the Successful Bidder, the company reserves the right to get it done through any other agency entirely at the risk and cost of the Successful Bidder.

43. **Company's right:**
The company reserves the right to increase/ decrease the tendered quantity of any or every item and delete any item at any stage of work at the accepted rates. The Successful Bidder's claim for compensation or damages on account of these shall not be entertained.

44. **Revisions:**
The Company reserves the right to revise the specifications, drawings and designs at any stage of work. Such deviations shall be adjusted at the rates already contained in the work order or at the prevailing market rates, if the rates are not available in the work order. Quantities given in tender are approximate only & may vary on either sides during construction. Successful Bidder shall have no extra claims for revision in accepted rates on this account. Successful Bidder shall complete entire work including revision in quantity at his quoted rates only.

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45. **Measurements:**
All works shall be measured as per the procedure laid down in relevant BIS standards (latest edition) and final payment shall be as per the measured quantities and not as per work order quantities.

46. **Progress report of work:**
Successful Bidder shall report and submit progress report of the work fortnightly to the concerned office, which has awarded the contract.

47. **Maintenance of instruction book;**
The Successful Bidder at site will maintain an instruction book serially numbered having one original and two copies of each page so that our visiting officers/ site engineers can issue instructions regarding progress and quality of work to the Successful Bidder. The Successful Bidder or the Successful Bidder's representative will sign in the instruction book in token of receipt of and understanding of such instruction. The original copy of the instruction page shall be sent too the concerned engineer and second copy will be retained by the issuing person and the third copy shall be retained by the Successful Bidder.

48. **Submission of bills:**
The bills will be submitted in company's measurement/ bills proforma only.

49. **Cancellation of order:**
If the performance of the successful Bidder is found to be unsatisfactory, the company reserves the right to cancel in part or whole of the contract and get the work executed through alternate means at the entire risk and cost of the Successful Bidder on whom the order was first placed. In such cases, the Successful Bidder shall make good all losses that the company may suffer due to this.

50. **Abandonment of work:**
In case the Successful Bidder abandons the work in spite of our notice, the company shall issue the final notice to the Successful Bidder to remain present at site for taking final measurements and in case the Successful Bidder does not report at site on due date and time as per the Company's notice, the company's representative will take unilateral measurements of abandoned work which will be binding on the Successful Bidder and the balance work will be carried out by any agency appointed by the company at the entire risk and cost of the Successful Bidder.

51. **Price adjustment for delay in completion:**
If the Successful Bidder does not complete the work within prescribed time limit given in the work order, price adjustment for delay in completion shall be made. This will be in addition to and without prejudice to the other rights available to the Company under the said GCC.

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52. **Disposal of surplus materials:**
Successful Bidder shall dispose off all surplus excavated materials/ earth available or any other item involving excavation in the following manner and as per the instruction of the site engineer.

i. Uniformly spreading the excavated materials/ earth within the premises, wherever required and rolling with light roller.

ii. Dispose off the surplus earth from the premises to outside the municipal limits or as permitted by the local authorities irrespective of load and mode of transportation involved.

iii. Written instruction should be obtained from site engineer about disposal of excavated material/ earth before commencement of excavation at site. No extra cost shall be payable for re handling of the same. If the earth is disposed off outside our site, the Successful Bidder shall be responsible to obtain permission from the concerned authority, if any.

iv. Clear the site by removing debris/ plants/ roots etc as per the instructions of the site engineer.

53. **Certification of works:**
It will the responsibility of the Successful Bidder to get the works approved and obtain certificate for all plumbing and electrical work from the local municipal/ other government/ required authorities.

54. **Company supplied materials:**
Any materials to be supplied by the company will be supplied anywhere within the premises. The transporting and handling of the same to actual location of installation will be Successful Bidder's responsibility for which no extra payment will be made. Any damage caused to our equipment/ property while handling and installing the will have to be made good by the Successful Bidder at his risk and cost.

55. **Works in operating terminal, Installation, depots.**
If the work is required to be performed in the working terminals, depots, installations, under such circumstances, the progress of work is likely to be interrupted on account of the operations of the depot/ terminal etc. The work may at certain times have to be stopped on the instructions of our site representative. Under such circumstances, the Successful Bidder should co-operate with company to avoid hindrance to the operations of the depot/ terminal/ installation. The working hours will be adjusted as per the company's representative, from time to time. Rules and regulations of the depot/ installation/ terminal shall be strictly followed by the Successful Bidder.

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The stoppage of work due to any reasons mentioned above shall not entitle the Successful Bidder for any claim of compensation whatsoever for idling of his labor/ machinery etc during such interruptions.

56. **Works by other Successful Bidders:**
Along with works covered under this tender, civil works etc may be carried out simultaneously by other Successful Bidders. The successful tenderer should extend full co-operation to the Successful Bidders and the works should be carried out in such a way as not to affect the progress of works. Any damage caused should be rectified by the representative Successful Bidder at his own risk and cost.

57. **Damage to existing facilities:**
Any damage caused to existing facilities while carrying out the work shall be made good by the Successful Bidder to our entire satisfaction at his own risk and cost.

58. **Statutory rules and regulations:**
The Successful Bidder will abide by the rules, regulations, bye laws and statutes etc. imposed by the government/ semi government and other local authorities for execution of this job.

59. **Omissions/ deletions:**
Any omission/ deletion noticed in the terms without the prior approval of the company shall result in rejection of the bid.

60. **Completion of contract:**
Acceptance of a facility(s) by the company does not constitute final completion of the contract. The contract shall be deemed to be executed in full and final measurement certified only when the Successful Bidder has fully discharged all obligations in terms of all contract documents.

61. **Safety of company supplied materials:**
Once the company supplied items are handed over to the Successful Bidder, the safety of the same is the Successful Bidder's responsibility.

62. **Security of Successful Bidder's materials:**
Company shall not be responsible for security of Successful Bidder's materials/ equipment.

63. **Observation of rules:**
In case the contract works is to be done within the terminal/ depot/ installation/ AFSs, the Successful Bidder shall have to observe all local rules for safety/ security/ gate passes etc as advised by the location-in-charge/ site engineer.

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64. **Storage space:**
No covered space shall be provided by DAFFPL for storage/ stacking of Successful Bidder's materials. The Successful Bidder shall make his own arrangement for the same.

65. **Safety:**
Since works have to be carried out in Airport-Apron, the Successful Bidder should ensure that day to day operations, safety and security of the location are not affected in any way on account of the works being carried out. In case of any damage to owner/client properties due to the negligence on the part of the Successful Bidder or their workmen, the Successful Bidder will be held responsible and liquidated damages as assessed by the company would be recover from them.

When hot works are involved, the following safety precautions have to be strictly observed before commencement of works.

i. All hot works operations should be carried out under the supervision of our representative and also under the supervision of responsible representative of the Successful Bidder and permit system to be complied as applicable at fuel farm and airport areas.

ii. All hot work operations should be undertaken only after issue of hot work permits by the location in charge on day to day basis.

iii. It should be ensured that the pipes, valve chambers etc where the hot work is required are gas freed and properly checked to this effect with explosive meters.

iv. It should be ensured that the surrounding area is free from oil, rags, oil spillage and other sources of ignition and the area is cleaned/ sprinkled with sand or dry earth. It should also be ensured that metallic trays filled with DCP powder are kept for collecting the welding arc/ hot metal cutting.

v. Hot work should commence only after positioning the portable fire extinguishers and sand/ dry powder in readiness at site.

vi. Match boxes, lighters etc used for hot work should be kept in the custody of the supervisor only.

vii. It should be ensured that no workmen carries match boxes or any other source of ignition with them while entering the premises or inside the premises.

viii. Welding sets should be switched off and power mains disconnected. If the connection is taken from a temporary switch board the fuse carriers should be removed and handed over to the supervisor.

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ix. Gas cylinder and the cutting sets should be properly closed and the equipment moved to a safe place.

x. The site of work should be examined to ensure that it is free from hot splatters and any other source of ignition.

66. **Water:**

Successful Bidder shall arrange the supply of Water for Construction.

67. **Power:**
Power required for this work shall be arranged by SUCCESSFUL BIDDER only.

68. COMPLETION PERIOD:
Time is the essence of the contract. The time period of contract is **06 (Six) months** from the date of hand over of site including monsoon period. **The time includes necessary time required for mobilizations and demobilizations after the execution of work and includes monsoon period.** Successful bidder is required to provide a bar chart /schedule showing the activities/events with time.

Escalation/Price Variation: No claim / additional fees on account of any price variation/Escalation on whatsoever ground shall be entertained at any stage of works. Quoted fees shall be firm and fixed for entire contract period as well as extended period if any for completion of the works.

69. COMPLETION FOR DELAY:

- The time allowed for carrying out the work as specified in above clause shall be strictly observed by the bidder and shall be deemed to be the essence of the contract on the part of the bidder. The work shall throughout, the stipulated period of the contract, be processed with all diligence.
- In case the bidder fails to complete the work within the Contract period or extended period as above owing to reasons attributable to bidder, liquidated damages @ 0.5% per week of the total amount subject to a maximum of 10% of the total amount payable shall be levied on the bidder.

70. **Defects Rectification Period:**
12 months from the date of successful completion of works as per contract. DAFFPL shall have the right, but not the obligation, to instruct the Contractor in writing, to Execute all such work of repair, replacement, amendment, reconstruction, rectification and make good defects, imperfections or other faults in the Works and/or any part thereof, as the case may be, during the Defects Rectification Period, either as a result of an inspection made by or on behalf of the Employer's Representative or as otherwise comes to the knowledge of the Contractor, at any time or times prior to its expiration.

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71. **PAYMENT TERMS:**

- All the payments due to the bidder shall be made online and no Cheques / draft shall be issued.
- Milestone payment schedule for various activities must be proposed by Bidder along with the tender document. However final payment terms will be finalized based on mutual agreement of DAFFPL & Successful Bidder.
- The successful bidder can submit running bills after completion of certain items in the BOQ and opt for the payment of the running bill. The successful bidder has the liberty to decide upon the number of running bills to be submitted for the project being executed by him.
- In case Mobilization Advance (10% of Contract Value) is paid to the successful bidder, it shall be permissible for the bidder to furnish Bank Guarantee to cover Mobilization Advance, which shall be subject to the following conditions:

    a. The Bank Guarantee will be for a value equivalent to 10% (ten percent) of the Total Contract Value, and shall be kept valid up to 3 (three) months beyond the expiry of the Defect rectification Period;
    b. Recoveries will be effected from each Running Account Bill at the rate of 10% (ten percent) of the gross bill value, till the entire Mobilization Advance is fully recovered.
    c. The Initial Bank Guarantee (BG) furnished by the successful bidder shall be refunded / returned after recovery of Mobilization Advance is effected from the R.A. Bills up to an aggregate amount equivalent to the Initial BG.
    d. All the other stipulations hereof in respect of BG shall apply.

72. CONTRACT PERFORMANCE BANK GUARANTEE [CPBG]

a) As a Performance security, the successful Bidder, to whom the work is awarded by, shall be required to furnish within 30 days of notification of award of contract (Letter/ Fax/e-mail of Intent) a Performance Bank Guarantee on RS.100/- VALUE non-judicial stamp paper in favour of the Owner (M/S DAFFPL).
b) The Bank Guarantee amount shall be equal to TEN PERCENT (10%) of the Total Order Value and it shall guarantee the faithful performance of the Order in accordance with the Terms and conditions specified in the documents and specifications.
c) CPBG shall be in the form of an irrevocable Bank Guarantee (in the format attached) issued by any Indian Scheduled Bank (other than Co-operative Bank).
d) The Bank Guarantee shall be valid for the entire period of the Contract, namely, till the end of the Defect Rectification Period. The guarantee amount

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shall be payable on demand to the Owner.

e) In case, the Contract Performance Bank Guarantee stated above gets reduced/ deducted for reasons of non-fulfillment of any Contractual obligations upto the completion of defects rectification period, the bidder shall immediately take action to increase the value of Bank Guarantee to TEN PERCENT (10%) of the Contract price, to cover his obligations.

f) The Performance Guarantee will be returned to the bidder without any interest at the end of the defects rectification period subject to fulfillment of all contractual obligations by the Bidder. The bank guarantee shall have a claim period of 3 months beyond the contractual period.

g) The proceeds of performance security shall be appropriated by the owner as compensation for any loss resulting from bidder's failure to complete his obligations under the contract to the prejudice to any of the rights or remedies the owner may be entitled to as per terms and conditions of contract. The proceeds of this performance security shall also govern the successful performance of goods and services and bidders all obligations during the entire period of contractual warrantee / guarantee.

73. **Tests and Inspection:**

The contractor shall carry out the various tests as enumerated in the technical specifications of this tender document and the technical documents that will be furnished to him during the performance of the work. No separate payment shall be made.

The contractor shall carry out at his cost, all the tests either on the field or through external institutions / laboratories, concerning the execution of the work and supply of materials by the contractor.

Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at this own cost. Results of all inspection & tests shall be recorded in the inspection reports, test reports, etc., which will be approved by the Engineer-in-charge. These reports shall form part of the completion documents.

Inspection & Acceptance of works shall not relieve the contractor from any of his responsibilities under this contract.

74. **Site Cleaning:**

The contractor shall take care to clean the working site from time to time for easy access to work site and for safety. Working site should be always kept cleared to the entire satisfaction of DAFFPL.

Before handing over any work to the owner, the contractor in addition to other formalities to be observed as detailed in the document shall clear the site to the

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entire satisfaction of DAFFPL.

75. **Coordination with other Agencies:**
Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the contractor. Proper coordination with other agencies will be the responsibility of the contractor. In case of any dispute, the decision of Engineer-in-charge shall be final and binding on the contractor.

76. DAFFPL reserves the right to accept any tender in whole and reject any or all tenders without assigning any reason. DAFFPL also reserves the right to allow public enterprises (Central/State) Price / purchase /contract / service preference as admissible under the Indian Government Policy.

77. BID PRICES:

a) Bidder should quote their lowest and best offered price. Prices so quoted will remain firm till satisfactory completion of order. The price will not be subjected to escalation for any reason whatsoever.
b) Bidders quoted prices shall be deemed to include entire Specification of item and all obligations and responsibilities to be carried out / executed by the Bidder as per terms of tender document. It is clearly understood by the Bidder that it is for the Bidder to ascertain and assess the applicable Acts/ Regulations/ Laws etc., entirely of their own. It is also for the Bidder to ascertain and assess the applicability of taxes, duties, levies etc. In case of any difference of opinion between Bidders proposal and interpretation by any tax/assessing (or similar) authorities, on the rate or terms and conditions related to taxes and duties etc., owners liability shall be strictly as per terms/provisions of the contract based on tender document and Bidders offer.
c) No other charges accept those mentioned in the tender document will be payable to bidder.

78. The materials should be properly packed so as to withstand all transit hazards. Materials are required to be dispatched by the bidder to the locations, on freight paid DOOR- DELIVERY CONSIGNEE COPY ATTACHED basis along with copies of Inspection release note & internal test certificates & other documents as mentioned elsewhere in this tender document.

79. All shipment shall be under deck unless carriage on deck is unavoidable.

80. Bidder to note that Special Packaging Requirement as in technical specifications of this tender. The materials should be properly packed so as to withstand all transit hazards (both ocean & inland transit).

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81. Indian agent Commission will not be paid by the owner.

82. TAXES & DUTIES:

a) Bidder(s) quoted prices shall be exclusive of all taxes, duties, cess, levies etc.,

b) The invoice should clearly mentioned that applicable Excise Duty, Education Cess or any other taxes charged and paid / payable on quoted item to enable the owner to claim MODVAT / Input credit.

c) The statutory variation in Excise duty, Education Cess and Sales tax / VAT on finished goods and introduction of new tax, from bid due date till the contractual completion period shall be to owner account against submission of the documentary evidence. However, any increase in the rate of these taxes and duties beyond the contractual delivery period shall be to Seller account. Any decrease in the rate of these taxes and duties shall be passed on to the owner. Any additional excise duty due to increase in turn-over would be to seller account.

d) It is for the Bidder to assess and ascertain the rate of GST, excise duty, education Cess and sales tax/VAT applicable on quoted items. It is clearly understood that Owner will not have any additional liability towards payment of Excise Duty, Education Cess, GST and Sales Tax/VAT which is based on Bidders wrong assessment / interpretation of applicability of such Excise Duty and/or education cess and / or Sales Tax/VAT.

e) Successful bidder shall carry out its obligations towards services at site as mentioned in technical specifications without any extra charges.

f) Octroi/Entry tax, if any, in the any state of India shall be directly paid by the bidder, if applicable.

g) DAFFPL shall not be liable, in case the tax authorities assess the tax elements in a different way on account of any reason, whatsoever.

h) Taxes and duties other than those specified in this document, if any, shall be included in the quoted prices and no separate reimbursement shall be made by DAFFPL.

83. Income Tax / Corporate Tax:

a) As regards Income Tax, Surcharge on Income Tax or any other Corporate Tax payable by the Bidder for reason of the contract awarded, and / or on their expatriate personal, the Owner shall not bear any Tax liability whatsoever, irrespective of the mode of construction of contract / order. The Bidder shall be liable and responsible for payment of such tax, if attracted under the provision of Indian Income Tax Act.

b) Bidder may note that if any tax is deductible at source as per Indian Income Tax Law, the same will be so deducted before releasing any payment to the Bidder and a TDS (Tax deducted at source) certificate will be furnished to the Bidder.

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c) Accordingly, Bidder shall have the responsibility to check and include such provision of taxes in the prices.
d) In case of delay in delivery due to reasons attributable to Bidder, any new or additional taxes or duties levied by Statutory authorities during this period shall be borne by the Bidder.

84. INSURANCE

Supplier shall carry and maintain any and all statutory insurance(s) required under Indian Laws and Regulations, including Workmen compensation Act/ESI/Third party liabilities etc. and insurances for their personnel engaged in performance of the work at their own cost.

85. INSPECTION:

a) Material / construction shall be inspected by owner or its representative. Charges other than third party inspection, is entirely bidder responsibility and in no way should affect the completion schedule.
b) OWNER may, at its own expense, witness any test or inspection. In order to enable OWNER to witness the tests/inspections OWNER will advise the bidder in advance whether it intends to be present at any of the inspections.
c) Even if the inspection and tests are fully carried out, the Bidder shall not be absolved from its responsibilities to ensure that the Material(s), raw materials, components and other inputs are supplied strictly to conform and comply with all the requirements of the Contract at all stages, whether during manufacture and fabrication, or at the time of Delivery as on arrival at site and after its erection or start up or consumption, and during the defect liability period. The inspections and tests are merely intended to prima-facie satisfy OWNER that the Material(s) and the parts and components comply with the requirements of the Contract. The Bidder s responsibility shall also not be anywise reduced or discharged because OWNER or OWNER s representative(s) or Inspector(s) shall have examined, commented on the Bidder s drawings or specifications or shall have witnessed the tests or required any chemical or physical or other tests or shall have stamped or approved or certified any Material(s).
d) Although material approved by the Inspector(s), if on testing and inspection after receipt of the Material(s) at the location, any Material(s) are found not to be in strict conformity with the contractual requirements or specifications, OWNER shall have the right to reject the same and hold the Bidder liable for non-performance of the Contract.

86. RISK PURCHASE CLAUSE: We reserve the right to curtail or cancel the order either in full or part thereof if bidder fails to comply with delivery schedule and other terms & conditions of the order. DAFFPL also reserves the right to procure same or similar materials/equipment through other sources at bidder's entire risk, cost and consequences.

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87. TEST & PERFORMANCE CERTIFICATES: Bidder shall furnish Material test and Performance Certificates for the materials along with the challans and invoice.

88. Only in the event of causes of Force Majeure occurring within the contractual delivery period and if they impede the performance of contract, the delivery dates shall be extended on receipt of application from the bidder / Owner without imposition of penalty. Only those causes which depend on natural calamities, civil wars, fire and national strikes which have duration of more than seven consecutive calendar days are considered the causes of force Majeure. The decision of Owner shall be final and binding on bidder.

89. The Bidder must advise the Owner by a registered letter duly certified by Local Chamber of Commerce or statutory authorities and Owner must advise the Bidder by a letter, the beginning and the end of the delay immediately, but in no case later than within 10 days of the beginning and end of such causes of Force Majeure condition as defined above. Provided further that if the performance in whole or part of any obligation under this contract is prevented or delayed by reason of any such event for period exceeding 60 days either party may at its option terminate the contract.

90. Repeat Order: DAFFPL reserves the right to place repeat order up to the order quantity within SIX MONTHS from the date of original order on mutual agreement basis.

91. Any reference to the Govt. Acts /Regulations etc. in the Bid Document is only indicative, and it is entirely for the bidder to ascertain the applicable Acts/Regulations.

92. Rejected material lying in Owner premises must be replaced within 15 days from date of final report on rejection of material.

93. RECOVERY OF SUMS DUE: Whenever, any claim against bidder for payment of a sum of money arises out of or under the contract or in any other form, the owner shall be entitled to recover such sums from any sum then due or when at any time thereafter may become due from the bidder under this or any other form and should this sum be not sufficient to cover the recoverable amount of claim(s), the bidder shall pay to DAFFPL on demand the balance remaining due.

94. PATENTS & ROYALTIES: The bidder shall fully indemnify owner and users of materials specified herein/supplied at all times, against any action, claim or demand, costs and expenses, arising from or incurred by reasons of any infringement or alleged infringement of any patent, registered design, trademark or name, copy right or any other protected rights in respect of any materials supplied or any

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arrangement, system or method of using, fixing or working used by the bidder. In the event of any claim or demand being made or action sought against Owner in respect of any of the aforesaid matter, the bidder shall be notified thereof immediately and the bidder shall at his/its own expense with (if necessary) the assistance of Owner (whose all expense shall be reimbursed by the bidder) conduct all negotiations for the settlement of the same and/or litigation which may arise thereof.

95. LIABILITY CLAUSE: In case where it is necessary for employees or representatives of the Bidder to go upon the premises of owner, bidder agrees to assume the responsibility for the proper conduct of such employees/representatives while on said premises and to comply with all applicable Workmen s Compensation Law and other applicable Government Regulations and Ordinances and all plant rules and regulations particularly in regard to safety precautions and fire hazards. If this order requires bidder to furnish labour at site, such bidders workmen or employees shall under NO circumstances be deemed to be in owner s employment and bidder shall hold himself responsible for any claim or claims which they or their heirs, dependent or personal representatives, may have or make, for damages or compensation for anything done or committed to be done, in the course of carrying out the work covered by the purchase order, whether arising at owner s premises or elsewhere and agrees to indemnify the owner against any such claims, if made against the owner and all costs of proceedings, suit or actions which owner may incur or sustain in respect of the same.

96. COMPLIANCE OF REGULATIONS: Bidder warrants that all goods/Materials covered by this order have been produced, sold, dispatched, delivered and furnished in strict compliance with all applicable laws, regulations, labour agreement, working condition and technical codes and statutory requirements as applicable from time to time. The bidder shall ensure compliance with the above and shall indemnify owner against any actions, damages, costs and expenses of any failure to comply as aforesaid.

97. REJECTION, REMOVAL OF REJECTED GOODS AND REPLACEMENT: In case the testing and inspection at any stage by inspectors reveal that the equipment, materials and workmanship do not comply with specification and requirements, the same shall be removed by the bidder at his/its own expense and risk, within the time allowed by the owner. The owner shall be at liberty to dispose off such rejected goods in such manner as he may think appropriate. In the event the bidder fails to remove the rejected goods within the period as aforesaid, all expenses incurred by the owner for such disposal shall be to the account of the bidder. The freight paid by the owner, if any, on the inward journey of the rejected materials shall be reimbursed by the bidder to the owner before the rejected materials are removed by the bidder. The bidder will have to proceed with the replacement of the equipment or part of equipment without claiming any extra payment if so required by the owner. The time taken for replacement in such event will not be

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added to the contractual delivery period.

98. NON-WAIVER : Failure of the Owner to insist upon any of the terms or conditions incorporated in the Purchase Order or failure or delay to exercise any rights or remedies herein, or by law or failure to properly notify Bidder in the event of breach, or the acceptance of or payment of any goods hereunder or approval of design shall not release the Bidder and shall not be deemed a waiver of any right of the Owner to insist upon the strict performance thereof or of any of its or their rights or remedies as to any such goods regardless of when such goods are shipped, received or accepted nor shall any purported oral modification or revision of the order by DAFFPL act as waiver of the terms hereof. Any waiver to be effective must be in writing. Any lone incident of waiver of the any condition of this agreement by DAFFPL shall not be considered as a continuous waiver or waiver for other condition by DAFFPL.

99. NEW & UNUSED MATERIAL: All the material supplied by the bidder shall be branded new, unused and of recent manufacture.

100. CANCELLATION:

a) DAFFPL reserves the right to cancel the contract/purchase order or any part thereof through a written notice to the bidder if –
   i. The bidder fails to comply with the terms of this purchase order/contract.
   ii. The bidder becomes bankrupt or goes into liquidation.
   iii. The bidder fails to deliver the goods on time and/or replace the rejected goods promptly.
   iv. The bidder makes a general assignment for the benefit of creditors.
   v. A receiver is appointed for any of the property owned by the bidder.
   vi. Any other conditions where owners commercial interest get affected.

b) Upon receipt of the said cancellation notice, the bidder shall discontinue all work on the purchase order matters connected with it. DAFFPL in that event will be entitled to procure the requirement in the open market and recover excess payment over the bidder s agreed price if any, from the bidder and also reserving to itself the right to forfeit the security deposit if any, made by the bidder against the contract. The bidder is aware that the said goods are required by DAFFPL for the ultimate purpose of materials production and that non-delivery may cause loss of production and consequently loss of profit to the DAFFPL. In this-event of DAFFPL exercising the option to claim damages for non delivery other than by way of difference between the market price and the contract price, the bidder shall pay to DAFFPL, fair compensation to be agreed upon between DAFFPL and the bidder. The provision of this clause shall not prejudice the right of DAFFPL from invoking the provisions of price reduction clause mentioned aforesaid.

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101. ANTI –COMPETITIVE AGREEMENTS/ABUSE OF DOMINANT POSITION : The Competition Act, 2002 as amended by the Competition (Amendment) Act, 2007 (the Act), prohibits anti- competitive laws and aims at fostering competition and at protecting Indian markets against anti- competitive practices by enterprises. The Act prohibits anti- competitive agreements, abuse of dominant position by enterprises, and regulates combinations (consisting of acquisition, acquiring of control and M&A) wherever such agreements, abuse or combination causes, or is likely to cause, appreciable adverse effect on competition in markets in India. DAFFPL reserves the right to approach the Competition Commission established under the Act of Parliament and file information relating to anti-competitive agreements and abuse of dominant position. If such a situation arises, then Bidders are bound by the decision of the Competitive Commission and also subject to penalty and other provisions of the Competition Act.

102. ASSIGNMENT: The Bidder can / does not have any right to assign his rights and obligations under these general purchase conditions without the prior written approval of DAFFPL.

103. GOVERNING LAW: These General Purchase Conditions shall be governed by the Laws of India.

104. AMENDMENT: Any amendment to these General Conditions can be made only in writing and with the mutual consent of the parties to these conditions.

105. ARBITRATION

a) Any 'dispute or difference of any nature whatsoever, any claim, cross-claim, counterclaim or set off of the Owner against the Consultant or regarding any right, liability, act, omission or account of any of the parties hereto arising out of or in relation to this agreement shall be refereed to the Sole Arbitration of the nominated Director of the Owner or of some Officer of the Owner who may be nominated by the nominated Director. The consultant will not be entitled to raise any objection to any such arbitrator on the ground that the arbitrator is an officer of the Owner or that he has dealt with the matters to which the contract relates or that in the course of his duties as an Officer of the Owner, he had expressed view on all or any other matters in dispute or difference. In the event of the arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason, the nominated Director as aforesaid at the time of such transfer, vacation of office or inability to act may in the discretion of the nominated Director designate another person to act as arbitrator in accordance with the terms of the agreement to the end and intent that the original Arbitrator shall be entitled to continue the arbitration proceedings notwithstanding his transfer or vacation of office as an officer of the Owner if the nominated Director does not designate another person to act as arbitrator on such

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transfer, vacation of office or inability of original arbitrator. Such person shall be entitled to proceed with the reference from the point at which it was left by his predecessor. It is also a term of this contract that no person other than the nominated Director of the Owner or a person nominated by such nominated Director as aforesaid shall act as arbitrator hereunder. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to the agreement subject to the provisions of the Arbitration & Conciliation Act,1996 or any statutory modification or reenactment thereof and the rules made there under for the time being in force shall apply to the arbitration proceedings under this clause.

b) The arbitrator shall have power to order and direct either of the parties to abide by, observe and perform all such directions as the arbitrator may think fit having regard to the matters in difference i.e. dispute, before him. The arbitrator shall have all summary powers and may take such evidence oral and/or documentary, as the arbitrator in his absolute discretion thinks fit and shall be entitled to exercise all powers under the Indian Arbitration & Conciliation Act 1996 including admission of any affidavit as evidence concerning the matter in difference i.e. dispute before him.

c) The parties against whom the arbitration proceedings have been initiated, that is to say, the Respondents in the proceeding, shall be entitled to prefer a cross claim, counter claim or set off before the Arbitrator in respect of any matter in issue arising out of or in relation to the Agreement without seeking a formal reference of arbitration to the nominated Director/officer for such counter-claim, or set off and the Arbitrator shall be entitled to consider and deal with the same as if the matters arising therefore has been referred to him originally and deemed to form part of the reference made by the nominated Director/officer.

d) The arbitrator shall be at liberty to appoint, if necessary any accountant or engineering or other technical person to assist him, and to act by the opinion so taken.

e) The arbitrator shall have power to make one or more awards whether interim or otherwise in respect of the dispute and difference and in particular will be entitled to make separate awards in respect of claims of cross claims of the parties.

f) The arbitrator shall be entitled to direct any one of parties to pay the costs to the other party in such manner and to such extent as the arbitrator may in his discretion determine and shall also be entitled to require one or both the parties to deposit funds in such proportion to meet the arbitrators expenses whenever called upon to do so.

g) The parties hereby agree that the courts in the city of Delhi alone shall have jurisdiction to entertain any application or other proceedings in respect of anything arising under this agreement and any award or awards made by the Sole Arbitration hereunder shall be filed (if so required) in the concerned courts in the city of Delhi only.

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CHAPTER 3: BID-QUALIFICATION CRITERIA:

Bidders need to meet following pre-qualification criteria to qualify for short-listing as a successful bidder:

SL	QUALIFYING PARAMETERS
1.	Should have successfully completed similar *works* during last 7 years ending **31.12.2018** as per following:
a)	Three similar completed works each costing not less than the amount equal to **Rs. 1.5 Crore.**
	OR
b)	Two similar completed works each costing not less than the amount equal to **Rs. 2.0 Crores**
	OR
c)	One similar completed work costing not less than the amount equal to **Rs. 2.5 Crores**
2.	Average Annual Financial Turnover during the last 3 years, ending **31st Mar' 2018** should be at least **Rs. 05 Crores** Note: The annual turnover is taken for last three financial years. If it is not submitted/mentioned "**Nil**" by the tenderer for a particular year, it shall be considered as Zero for computing average.

DEFINITION OF SIMILAR WORKS:

Similar works: Experience in successful execution and completion of works related to Hydro Carbon Pipeline Works.

Following documents shall be offered for verification on these days:

1. Work order and completion certificates or any other documents confirming having completed the works as per qualifying criteria.
2. PF Certificate
3. Annual Income Tax Returns for past three years
4. GST Certificate & PAN No copies.
5. Balance sheets or certificates of turnover for past three financial years.
6. Partnership deed in case of partnership firm and MOU & AOA in case of Limited Companies.

Sign & Stamp of Bidder

ANNEXURE-I

PROFORMA OF BANK GUARANTEE
(EARNEST MONEY DEPOSIT)
(On Non-Judicial Stamp paper for appropriate value)

BANK GUARANTEE NO. :
BANK GUARANTEE AMOUNT:
CLAIM:
(till 120 days from date of work order)
TENDER NO. /DATE:
JOB DESCRIPTION/
LOCATION:

Tender Security No. [*]

Name and Address of the Beneficiary: Delhi Aviation Fuel Facility (Private) Limited
Aviation Fuelling Station, Shahabad Mohammadpur, IGI Airport, New Delhi – 110 061, India

We [*name and address of the issuing bank*] have been informed that [*Name of the Interested party*] (hereinafter called the "Interested Party") is submitting a proposal for the Award of the Works in response to a Request for Proposal ("RFP") by Delhi Aviation Fuel Facility (P.) Ltd. ("DAFFPL" or 'Beneficiary") for [*Insert description of work*] ("Works"). The conditions of the RFP, which are set out in a documents entitled Request for Proposal dated [*Please insert*] require its offer to be supported by a Tender Security.

At the request of the Interested Party, we hereby irrevocably undertake to pay you without demur, the Beneficiary, any sum or sums not exceeding Rs. _____ [*Please insert*].

Upon receipt by us of your demand in writing and your written statement (in the demand) stating that:

1) The Interested Party has, without written consent of DAFFPL, withdrawn its offer after the latest time specified for its submission and before the expiry of its period of validity; or
2) The Interested Party has refused to accept the correction of errors in its offer in accordance with the instructions to Interested parties contained in the RFP; or

_____
Sign & Stamp of Bidder

3) DAFFPL entered in to the contract with the Interested party but the Interested party has failed to deliver the **COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE**) in compliance with the Contract conditions; or

4) The Interested Party has failed to enter into the Contract within 30 (Thirty) days of being required to do so by the Tender Officer.

Any demand for payment must contain your signature(s). The demand must be received by us at this office on or before the expiry of the earliest of the following dates, when this security guarantee shall expire and shall be returned to us:

a) Date of issue of letter communicating to the Interested Party that it has not qualified for the contract or the Proposal submitted by the Interested Party is unsuccessful or the TENDER is withdrawn and/or cancelled by the Beneficiary; or

b) 7 (seven) days after the date of delivery of an acceptable performance bond complying with the Contract conditions and execution of the Contract after the award of the works to the Interested Party; or

c) 120 (One hundred twenty) days from the last date of submission of Proposal in accordance with the TENDER.

Date:

Signature:

Designation:

Name of the Branch

_____

Sign & Stamp of Bidder

ANNEXURE-II

PROFORMA OF COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE)

(On Non-Judicial paper of Rs. 100/-value)

To,

DAFFPL

Dear Sirs,

M/s ……..have taken tender for the work ……for DAFFPL,.

The tender Conditions of Contract provide that the Successful Bidder shall pay a sum of Rs. …….. (Rupees ……..) as security deposit & performance guarantee in the form therein mentioned. The form of payment of security deposit & performance guarantee includes guarantee executed by Scheduled Bank at New Delhi, undertaking full responsibility to indemnify DAFFPL, in case of default. The said party …….. have approached us at and their request and in consideration of the premises we …….. having our office at …….. have agreed to give such guarantees as hereinafter mentioned.

1. We ----------hereby undertake and agree with you that if default shall be made by M/s. ----------in performing any of the terms and conditions of the tender or in payment of any money payable to Daffpl. We shall on demand pay to you, without demur, protest or requiring you to seek recourse to M/s _____, in such matter as to you may direct the said amount of Rupees ---------- ----only or such portion thereof not exceeding the said sum as you may from time to time require.
2. You will have the full liberty without reference to us and without effecting this guarantee, postpones for any time or from time to time the exercise of any of the powers and rights conferred on you under the contract with the said ---------- ----------and to enforce or to forbear from endorsing any powers of rights or by reason of time being given to the said ----------which under law relating to the sureties would but for provision have the effect of releasing us.
3. Your right to recover the said sum of Rs. ---------- (Rupees ----------) from us in manner aforesaid will not be affected or suspended by reason of the fact that any dispute or

_____
Sign & Stamp of Bidder

disputes have been raised by the said M/s. ---------- and/or that any dispute or disputes are pending before any officer, tribunal or court.

4. The guarantee herein contained shall not be determined or affected by the liquidation or winding up dissolution or change of constitution or insolvency of the said ----------but shall in all respect and for all purposes be binding operative units payment of all money due to you in respect of such liabilities is paid.
5. Our liability under this guarantee is restricted to Rupees ----------our guarantee shall remain in force until ----------unless a suit or action to enforce a claim under Guarantee is filed against us within six months from ----------(which is date of expiry of guarantee) all our rights under the said guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under.
6. NOT WITHSTANDING anything hereinbefore contained our liability under this Bank Guarantee is restricted to Rupees ----------(Rupees ----------).This Bank Guarantee shall be valid up to ----------and we are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before.
7. This guarantee is to be returned to us within fifteen (15) days from the date it ceases to be in force. If the guarantee is not returned to us within the date of aforementioned it shall be automatically cancelled.
8. We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney dated ----------granted to him by the Bank.

Yours faithfully

----------Bank
By its Constituted Attorney
Signature of a person duly
Authorized to sign on behalf of the bank

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Sign & Stamp of Bidder

Annexure- III

Form of Letter of Undertaking

[On the letterhead of the Interested Party]

Letter of Undertaking

Date:

Delhi Aviation Fuel Facility (Private) Limited
Aviation Fuelling Station, Shahabad Mohammadpur,
IGI Airport, New Delhi – 110 061, India

Re:
The undersigned Interested Party acknowledges that the TENDER issued is confidential and personal to the undersigned Interested Party and hereby undertakes and agrees as follows:

1. "**Confidential Information**" means the TENDER and everything contained therein, all documentation, data, particulars of the Works and technical or commercial information made by (or on behalf of) Delhi Aviation Fuel Facility (Private) Limited or obtained directly or indirectly from Delhi Aviation Fuel Facility (Private) Limited or its representatives by the undersigned Interested Party or which is generated by the undersigned Interested Party or any information or data that the undersigned Interested Party receives or has access to, as a result of the TENDER, as being confidential information of Delhi Aviation Fuel Facility (Private) Limited, provided that such term does not include information that (a) was publicly known or otherwise known to undersigned Interested Party prior to the time of such disclosure, (b) subsequently becomes publicly known through no act or omission by undersigned Interested Party or any person acting on its behalf.

2. The undersigned Interested Party shall maintain the confidentiality of Confidential Information in accordance with procedures adopted by the undersigned Interested Party in good faith to protect confidential information of third parties delivered to it, provided that the undersigned Interested Party may deliver or disclose Confidential Information to its authorized representatives who agree to hold confidential the Confidential Information substantially in accordance with the terms of this Undertaking.

3. The undersigned Interested Party shall not at any time whatsoever:

   (i) Disclose, in whole or in part, any Confidential Information received directly or indirectly from the Delhi Aviation Fuel Facility (P) Limited to any third party.

   (ii) Reproduce, publish, transmit, translate, modify, compile or otherwise transfer the Confidential Information.

_____
Sign & Stamp of Bidder

4. In case the Proposal of the undersigned Interested Party is not accepted and immediately upon the acceptance of the Proposal of any of the other Interested Party, the undersigned Interested Party, shall:

(i) Return all Confidential Information including without limitation, all originals, copies, reproductions and summaries of Confidential Information; and

(ii) Destroy all copies of Confidential Information in its possession, power or control, which are present on magnetic media, optical disk or other storage device, in a manner that ensures that the Confidential Information is rendered unrecoverable.

5. The undersigned Interested Party shall certify to Delhi Aviation Fuel Facility (Private) Limited that it has returned or destroyed such Confidential Information to the Delhi Aviation Fuel (Private) Limited within two (2) days of such a request being made by Delhi Aviation Fuel (Private) Limited.

Name of Interested Party's

Signature **of Authorized Representative**

_____

Sign & Stamp of Bidder

Annexure IV

DECLARATION to be submitted along with Technical Bid

(M/s.) hereby declare / clarify that we have not been banned or delisted by any government or quasi Government agencies or Public Sector Undertakings.

Stamp & Signature of the Consultants

NOTE: If Consultants has been banned by any Government or quasi Government agencies or PSUs, this fact must be clearly stated with details. If this declaration is not given along with the technical bid, the tender will be rejected as non-responsive.

_____

Sign & Stamp of Bidder

DAFFPL

Let's fly high together !

EMPLOYER'S REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR Extension & Realignment of Aviation Fuel Hydrant System in IGI Cargo Terminal. New Delhi

Contents

1 Introduction

This Employer's Requirements specifies technical and performance requirements for the Aviation Fuel Hydrant System (***Hydrant System***) to serve Cargo Terminal at Delhi International Airport (the ***Airport***). The works detailed herein are referred to as the **Current Scope** or the subject Contract, as necessary. The contractor who performs the Works are termed as **Hydrant Contractor**

The Employer, as part of the airport expansion envisages "Realignment of three existing cargo stands and Construction of three new cargo stands". Accordingly, the fuel hydrant system serving the existing stands needs to be modified to suit the new alignment and subsequently construct the hydrant system for the three new stands.

All civil works pertaining to the fuel hydrant system are part of the current project scope

The entire Employer's Requirements (***ER***) shall be read in conjunction with Materials Take Off (***MTO***), wherever there is any ambiguity, MTO shall be given priority.

Based on Ground-Penetrating Radar (GPR) report and together with consultation with all relevant stakeholders, the Contractor shall finalise the layout of the Cargo Hydrant System.

Tie-in drawings and sketches included in this Tender are indicative. Contractor to propose final tie-in after interfacing with other services and approval from all stakeholders.

2 General Requirements

2.1 Preface

Contractor to note that any clarifications/queries raised by the Contractor on any issues including those related to ambiguities, insufficiency, incompleteness, omission, incorrectness, inaccuracy, discrepancies, impracticalities, incongruity or any other deficiencies in these Employer's Requirements or between the Employer's Requirements and the Contract and Background Information during the execution of the Works will not constitute any grounds entitling the Contractor for either additional cost claims or any extension of time under the Contract and any implications arising therefrom will be deemed to have been factored by the Contractor in its scope of Works, Works Programme and the Contract Sum. In case of any such ambiguity or discrepancy in the Employer's Requirements and/or the Contract and/or the Background Information, the Employer's Representative shall issue necessary clarifications or instructions which shall be final and binding on the Contractor.

2.2 Specifications

The Works shall be designed and constructed in compliance with recognised industry accepted practice which shall include without limitation the latest issues of the following standards and codes:

EI 1540	Design, construction, operation and maintenance of aviation fuelling facilities
EI 1541	Performance requirements for protective coating systems used in aviation fuel storage tanks and piping
EI 1542	Identification markings for dedicated aviation fuel manufacturing and distribution facilities, airport storage and mobile fuelling equipment
EI 1550	Handbook on equipment used for the maintenance and delivery of clean aviation fuel
EI 1560	Recommended practice for the operation, inspection, maintenance and commissioning of aviation fuel hydrant systems and hydrant system extensions
EI 1581	Specifications and laboratory qualification procedures for aviation fuel filter/water separators
EI 1584	Four-inch hydrant system components and arrangements (hydrant pit valves and intake couplers
EI 1585	Guidance in the cleaning of aviation fuel hydrant systems at airports
EI 1594	Initial pressure strength testing of airport fuel hydrant systems with water

JIG 1	Aviation Fuel Quality Control and Operating Standards for Into-plane Fuelling Services
JIG 2	Aviation Fuel Quality Control and Operating Standards for Airport Depots and Hydrants
EI/JIG Standard 1530	Quality assurance requirements for the manufacture, storage and distribution of aviation fuels to airports (which has replaced JIG 3)
AFQRJOS	The Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) for Jet A-1 embodies the requirements of the following two specifications: (a) British Ministry of Defence Standard DEF STAN 91-091/Issue 9 03rd October 2016 for Turbine Fuel, Kerosene Type, Jet A-1, NATO Code F-35, Joint Service Designation: AVTUR. (b) ASTM Standard Specification D 1655-16a for Aviation Turbine Fuels "Jet A-1" Jet fuel that meets the AFQRJOS is usually referred to as "Jet A-1 to Check List" or "Check List Jet A-1" and, by definition, generally, meets the requirements of both of the above specifications.
API 5L	Specification for Line Pipe
API 6D	Specification for Pipeline Valves
API 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
API 650	Welded Tanks for Oil Storage
API 1110	Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API 1632	Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems
API 4716	Buried Pressurized Piping Systems Leak Detection Guide
ASME B16.5	Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
ASME B16.20	Metallic Gaskets for Pipe Flanges
ASME B16.34	Valves Flanged, Threaded, and Welding End
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B36.10M	Welded and Seamless Wrought Steel Pipe
ASTM A105 / A105M	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A234 / A234M	Standard Specification for Piping Fittings of Wrought Carbon

	Steel and Alloy Steel for Moderate and High Temperature Service
BS EN 14015	Specification for the Design and Manufacture of Site Built, Vertical, Cylindrical, Flat-Bottomed, Above Ground, Welded, Steel Tanks for the Storage of Liquids at Ambient Temperature and Above
BS EN 14161:2011	Petroleum and natural gas industries. Pipeline transportation systems
DIN 30670	Polyethylene coatings on steel pipes and fittings - Requirements and testing
DIN 30672	Field coating materials for corrosion protection of buried pipelines - Part 2: Application and quality control on site
PD 8010-1:2004	Code of practice for pipelines - Steel pipelines on land
AS/NZS 2885.5	Pipelines - Gas and liquid petroleum - Field pressure testing
Indian Regulations	Petroleum Rules 2002
Indian Regulations	CCOE & PESO
Indian Regulations	OISD

- Any other local statutory obligations and regulations applicable to Works

Where no code, specification or recommended practice is stated the Contractor shall propose the standard to apply for Employer's approval.

Safeguarding Aviation Fuel quality is a prime design consideration, therefore any dirt, water traps, and "dead legs" shall be eliminated in the design by the Contractor.

The construction should be "fit for purpose" in all aspects: including but not limited to:

- Operation
- Maintenance
- Commissioning
- Constructability
- Extendibility
- Safety
- Environment

2.3 Scope of Work

2.3.1 Summary

The general scope of works (but not necessarily in this sequence) forming part of the Works includes but not limited to and shall be performed in accordance with the Contract, Applicable Laws and Good Industry Practice:

- Mobilisation
- Set up temporary facilities

- Raise Employer tender drawings and design to a constructable design including shop drawings. Due to the nature of the project in which changes to the design are instructed by Employer from time to time, this may require that Contractor has to carry out further detail engineering from the tender drawings issued.
- Procure ALL materials including temporary ones.
- Carry out any piling necessary for pipeline routing
- Excavation and Backfill are part of contractor's scope
- Backfill trenches and reinstate up to bottom of pavement level which is approximately 2.5m to 3m over the TOP (considering the pavement depth ranging from 0.5m to 0.8m). Construction of pavement (PQC) is part of civil contractor's scope.
- Compacted sand surround of 300mm shall be provided around the pipe. On top of the sand bed Controlled Low Strength Material (CLSM) shall be filled up to the bottom of pavement.
- Shop fabricate, pressure test and soak test new spools (as necessary)
- All civil work including but not limited to Excavation, backfill of trenches, construction of valve chambers, water proofing etc are part of current scope of this project.
- Line sizing shall be as per MTO.
- Field fabrication/installation and tie-in of new main lines, risers, spools, low point drains, high point vents, hydrant pit boxes and hydrant pit valves to existing hydrant system
- Make end closures to lines (e.g. end cap, blind-flanged end inside chamber) such that future phases of this project can be tied-in with the minimum disruption/extra works.
- Coat and wrap welds including holiday tests.
- Pressure test and soak test all the modified section and the new sections of hydrant line/spur/riser

2.3.1.1 Existing Stands (104 to 106)

- Existing pipe line from VC-01 to VC-04 shall be positively isolated from T2.
- Drain the fuel from existing lines, gas freed and ensured that no hydrocarbon vapour remains in the system.
- Existing stands has to be demolished and the Top of Pipe (TOP) will be daylighted for the current scope. Where there are risers, the same will be exposed completely and subsequently modify the risers to position the hydrant pit at the desired location.
- Existing Pit boxes shall not be reused for the current scope as the existing pit boxes may be integral part of the demolished debris.
- Any Equipment that is intended to be reused shall be certified by the respective equipment supplier to confirm the fitness level. If for any reason, such certificate is not obtained, then hydrant contractor shall supply new equipment at its own cost.

- If found fit, Hydrant Valves, Emergency Shutoff valves (under hydrant valve), HPV, LPD may be reused.
- Existing riser shall be cut at 500mm from the weld-o-let and new pipe section shall be constructed subsequently.
- Existing riser pipe may be reused if the external coating (in turn the pipe) is not damaged by the excavation process.
- Upon obtaining realigned design, hydrant contractor to check and validate the refuelling study to confirm the location of hydrant pits with respect to the centre lines.

2.3.1.2 New Stands (107 to 109)

- Tie-in to the existing valve chamber VC-01
- In the absence of access to existing valves, the same shall be provided.
- Hydrant system contractor's scope includes but not limited to "GPR survey, trial holes, checking for interfaces, excavation, pipe lowering, welding, mechanical work completion & preservation for further Testing & Commissioning. Backfilling the sections as appropriate with the construction schedule and front availability.
- Hydrant system contractor shall provide 1.5m square hydrant pit surround "biscuit" (raised 25mm above surrounding apron level)
- Flush each new main line, spur and riser. Contractor shall supply all necessary labour and temporary materials, tools and equipment for flushing.

2.3.2 General scope

The particular scope of work consists of, but is not limited to, the installation of approximately 208m of new DN250 (10 Inch NPS) whilst tapping in existing header to be made to connect to the new risers & tapping from existing risers. 82m of new DN150 (6 Inch NPS) pipe to new hydrant pits, including pit boxes and hydrant pit valves, low point drains and high point vents on 3 new stands and 3 realigned parking stands. Only manually operated plug valve is envisaged and accordingly no power requirement for valve is envisaged with VC-N1. All cabling related to the current scope shall be routed to the nearest marshalling box as Instructed by the Employer

the Contractor is required to undertake electrical and instrumentation works such as provision, installation and commissioning of:

- emergency shutdown (ESD) pushbutton stations on apron stanchions;
- cabling of ESD functionality back to the marshalling box in the proximity;
- Leak Detection / Tightness Monitoring system instrumentation, cabling
- Cathodic Protection system (both temporary and permanent)

It is hereby clarified that Contractor will be required to carry out residual engineering works in order to:

(i) raise the tender design to shop drawing status sufficient for Contractor to proceed;

(ii) take into account local issues on-site such as the lack of comprehensive final apron levels.

(iii) take into consideration the ergonomics for maintenance and operation of equipment, e.g. valve maintenance and repair clearances, ease of valves removal, orientation of valves etc.; and

(iv) check the interface with all the services (both underground and above ground) and code compliance shall be ensured.

All drawings prepared by the Contractor for the Works shall be prepared and issued in compliance with the tender drawings of the Tender Documents. The Contractor is required to carry out whatever further engineering is required for the completion of the Works. Such details shall be submitted to the Employer for approval prior to execution of the Works in accordance with the Contract.

Reuse of any pipes/fittings/equipment etc shall be on the discretion of the Employer. Contractor shall submit the dossier to prove the fitness which will be scrutinised by Employer and instructed accordingly.

2.3.3 Subject Aircraft Parking Stands

Refer to drawings for details.

2.3.4 Airside Works

Airside activities shall be performed in accordance with an execution plan approved by the Employer and all other interface parties.

All activities and access shall be conducted under regulation exercised by Employer.

2.3.5 Airside Works Safety, Health & Environment

In case the Works are executed in an operations area, a work permit is required to be obtained from the user department prior to start the Works in operational areas as per the format issued by THE EMPLOYER.

Contractors are required to provide high visibility jackets to all workers, without which they will not be allowed to enter the operational area to execute the Works.

Contractors shall ensure that all safety precautions are taken during execution of Works and safety rules/laws/instructions issued by the appropriate authority and/or THE EMPLOYER shall be strictly complied with.

Contractors shall indemnify and keep on indemnifying THE EMPLOYER for any loss, damage or cost that may arise/ be imposed on THE EMPLOYER on this account.

Contractors shall be responsible for conducting their activities in IGIA premises in an environmentally responsible and eco-friendly manner, thereby complying with O&M standards of OMDA. They shall prevent and minimize environment pollution, induce healthy work practises within IGIA premises and shall adopt best environment management practises during their course of work. Contractor shall follow the environment management guidelines and shall be responsible for the waste & debris disposal in an environmentally safe manner.

2.3.6 Standard of Works

A high standard of workmanship is essential and all work must be carried out to the satisfaction of the Employer and in accordance with the Contract. Works found not to be to the required standard or in accordance with the Contract shall be rejected and shall be

rectified at no cost to the Employer and the cost of the Contractor. Faulty materials and equipment shall also be replaced at no additional cost to the Employer and the cost of the Contractor.

Particular attention shall be paid to general appearance and neatness of work.

Full care and protection of equipment shall be maintained during the period from delivery on Site, through testing and inspection, to completion and hand-over to the Employer in accordance with the Contract. This shall include coating of exposed surfaces, together with any other provisions, as may be necessary, for the purpose of adequate maintenance and protection of the Works.

The piping work shall be constructed in a logical manner, performed in a safe and expedient sequence to allow progressive completion, testing, pre-commissioning and staged commissioning and partial hand-over in accordance with the Contract and these Employer's Requirement. The general philosophy shall be to construct piping away from valves in valve chambers or other fixed points, not towards them. This is in order to minimise fit-up errors and stresses.

Site safety, environmental protection, and security shall be of paramount concern throughout the whole period of works' execution.

Contractor shall provide all necessary temporary drains or containment and silt traps to existing drainage and shall pump away any water trapped in any trench to the requirements of Employer.

Domestic facilities, toilets, showers, mess-rooms and cooking facilities shall be regulated and maintained to avoid unhygienic conditions and any vermin infestation.

Material storage areas shall be properly designated, secured and maintained to avoid deterioration of materials and equipment, theft, misuse and accidental damage.

Material transportation, unloading, loading, lifting and general handling shall be performed in a safe and professional manner to avoid damage and accident.

All lifting and rigging equipment shall be fit for purpose and have current load testing certification and must comply with Applicable Laws rules and regulations, prescribed by the Relevant Authority.

All site transport, cranes, or any other vehicle shall be of a good condition and fit for the purpose intended. All operators and drivers of such equipment shall be suitably qualified and experienced including without limitation holding a current permit issued by Employer to drive on the Airport airside.

All specialist or seemingly critical activities shall be performed in accordance with method statements approved by the Employer.

All scaffolding, ladders and other means of access shall be of proper manufacture, correctly erected and shall be inspected and certified by an authorised person of Contractor prior to usage. All scaffolding, ladders and other means of access shall display a readily identifiable tag demonstrating when it was certified by such authorised person and the conditions of certification validity including recertification and expiry. All scaffolding erection shall comply with all Applicable Laws rules and regulations, prescribed by the Relevant Authority.

Trenches and excavations shall be battered back or shuttered to prevent collapse. All trenches and excavations shall be barricaded off at least one (1) metre from the edge of the excavations. Safe access shall be provided for all excavations and trenches, large excavations shall have more than one (1) means of exit. No equipment shall be placed at the edge of an excavation without support plates or suitable timbers being in place. All shoring

protection work shall be accordance all Applicable Laws rules and regulations, prescribed by the Relevant Authority.

NDE shall be conducted in accordance with Applicable Laws and rules and regulations prescribed by the Relevant Authority. This shall only be performed by authorised and suitably qualified personnel.

No work shall proceed unless the relevant drawing(s), method statement(s), risk assessment(s) have been approved by the Employer.

Drawings shall be interpreted in accordance with Good Industry Practice.

Accurate "As-built" drawings and records shall be maintained throughout the construction period by Contractor and final "As-built" drawings (in CAD form and hard copies) shall be submitted to Employer as set out in the Contract.

The whole of the Works shall be subject to the approval of the Employer throughout. Employer approval shall in no way alleviate any contractual obligations.

2.4 Project Reporting and Meetings

2.4.1 Reporting

Contractor shall submit reports to Employer as follows:

- Daily report of previous day's activities with cut off at 06.00 hrs and submitted at 08.00 hrs.
- Weekly report submitted at 08.00 hrs every Monday (Contractor shall submit its own format with the Technical Proposal for approval of the Employer)
- Monthly progress report including: updated programme, histogram, project photographs, variation status (Contractor shall submit its own format with the Technical Proposal for approval of the Employer)

2.4.2 Meetings

Regular meetings shall be held:

- Daily co-ordination meeting
- Weekly meeting
- Monthly progress meeting

Ad hoc meetings shall be held as necessary by the Employer.

Contractor shall invite Employer to meetings and Employer will decide whether or not to attend. Contractor shall produce and distribute minutes of the meeting to Employer within 48 (forty-eight) hours of that meeting. Contractor shall invite other relevant parties (including those required by the Employer) to daily coordination meetings in order to ensure efficient progression of the Works, Employer will assist in liaising with such other parties as necessary.

In all cases, Contractor will give Employer a minimum of 7 (seven) days' prior notice of meetings except in the case of a meeting which has to be called on an emergency basis. For the avoidance of doubt, the 7 (seven) days' notice period shall also apply to HAZOP meetings per Section 2.5 hereto.

These meeting will be over and above the meeting that may be called by the Employer pursuant to the Contract.

2.5 HAZOP and Risk Assessment

A HAZOP will be carried out for the design and construction and Contractor shall actively participate. Contractor will arrange for chairing/facilitation of the HAZOP who will prepare minutes of the HAZOP including detailed action items, and shall allocate action items and monitor and record the close-out of such action items. The HAZOP is intended to identify, evaluate and mitigate risk in the design and the construction of the Works.

Contractor shall be responsible to raise the design from the tender design to a fully constructable design (including without limitation the preparation of shop drawings, method statements, work procedures, programmes and plans to the extent necessary) and this shall include without limitation carrying out any design amendments or revisions that result from the HAZOP.

Contractor shall be responsible to arrange, invite Employer and any other relevant parties to (including those parties suggested by the Employer), and conduct further HAZOP/HAZAN processes as Contractor or Employer indicate as being necessary in order to identify, evaluate and mitigate risk in the further stages of the Works. This obligation shall also include preparation of minutes of HAZOP/HAZAN including detailed action items, and shall allocate action items and monitor and record the close-out of such action items. As a minimum it is foreseen that one or more HAZOP processes will be required for the pre-commissioning and commissioning phases of the Works.

2.6 Completion - As-Built Dossier

Within one (1) month of physical works completion or handover (whichever is sooner) of final hydrant sections or as may be stipulated in the Contract, on each of the new stands Contractor shall submit to Employer for review and approval three (3) as-built dossiers (one original and two copies) containing the following information as a minimum.

2.6.1 Construction

- as-built drawings including coordinates of all nodes:
  - hydrant pits
  - low point drains
  - high point vents
  - changes in direction (horizontal and vertical)
  - branches and tie-ins
  - piping invert levels
- welder qualifications
- weld procedure qualifications
- materials usage including unique identification and location of each pipe, valve, assembly etc.
- materials usage actual vs. supplied (including Contractor-furnished materials)

- weld logs
  - weld number
  - size
  - pipe WT/SCH
  - weld type
  - weld date
  - identification of welder(s) producing each weld (root/fill/cap)
  - weld visual inspection date
  - radiography report number and date:
    - original weld
    - 1st repair
    - 2nd repair
  - MPI/liquid penetrant report number
  - comment
- all NDE records and reports including:
  - weld radiographs
  - coating holiday tests
- soil test repots for Contractor works (e.g. trenches)
- concrete test reports (compressive strength at 7 and 28 days)

2.6.2 Pre-commissioning

- test and checks carried out prior to filling with fuel to prove that proposed test section is tight
- filling with fuel – theoretical calculated volumes required, actual volumes used, volume reconciliation thereto in both total for each section and stage-wise
- soak test results – coupons and construction
- pressure test results – field measurements (equipment IDs, temperatures – ambient/fluid, pressures, volume of fuel used/added/subtracted, weather etc.), calculations, calibration certificates
- leak test results

2.6.3 Commissioning

- flushing results (filter membrane test results and membranes, fuel volumes used etc.)

2.6.4 Contractor-to-Employer Handover Check Sheets

For each hydrant pit / low point drain / high point vent / valve chamber (as appropriate) to show a signed record of Employer acceptance:

1. Cleanliness of hydrant pit boxes / valve chamber

2. Installation of hydrant pit valves and hydrant pit boxes, valves and peripherals (including sealing against water ingress)
3. Clearance between top of hydrant pit valve and underside of hydrant pit box cover
4. Marking of hydrant pit (red colour painting) / valve chamber
5. Numbering of hydrant pit / valve chamber
6. House-keeping

The abovementioned records are in addition to and not in substitution of any records required to be submitted by the Contractor to the Employer pursuant to the Contract.

2.7 General Description

2.7.1 Hydraulic Check

The Hydrant System is checked for the velocity limits in the main header (only at the new cargo length of 208m and not for the overall length from fuel farm to cargo) to confirm its compliance with NFPA. Accordingly, with the design pressure of 19.2 bar and with the assumption of one hydrant pump running at its duty flow of 275 m3/Hr in a DN250 pipe is analysed. Results of the analysis is tabulated below.

S.No	Description	Units	Results
1	Cross sectional area	Sq.mtrs	0.05
2	Pipe thickness	mm	9.27
3	Pipe diameter	mm	273.05
4	Pipe Schedule	Unitless	40.00
5	Reynolds number	Unitless	254508.00
6	Relative roughness	Unitless	0.0002
7	Friction factor	Unitless	0.02
8	Pipe Velocity	m/s	1.50

Tabulated value confirms that the selected pipe size is in compliance with the velocity requirement as per NFPA. However, it is contractor's responsibility to validate the sizing and confirm the same.

2.7.2 Hydrant System

The Hydrant System shall comprise the underground distribution piping and fuel hydrants. It shall be terminated at VC-N1 and shall be complete up to and including aircraft fuel hydrant pits.

The requirements for polyethylene coated and epoxy internally lined pipe and fittings, field joint coating, valves and fittings including drain and vent valves, hydrant valves, manual valves, valve pits, and all associated works are included in this Employer's Requirements.

2.7.3 Electrical and Instrumentation (E&I)

The electrical components and systems included in this Employer's Requirements include the Emergency Shut Down (***ESD***) pushbutton stations (one at the head of every aircraft parking stand) and tie-back of relevant cabling using cable duct banks to the ESD operating console in the proximity as Instructed by the Employer.

Each ESB shall as a minimum comply with the following requirements:

1. Conform to IEC 60947-5-1.
2. Be equipped with four normally open and normally closed contact with positive action. At least one of the contacts shall change status on activation of the pushbutton, even in case of contact welding.
3. The contacts shall be rated for 250 V DC and shall be able to break min. 60W inductive load at 120V DC for min. 100,000 operating cycles. The impulse withstand voltage shall be min. 6 kV.
4. In addition to the main circuit contacts each ESB shall be equipped with one normally open auxiliary contact, mechanically linked to the main contacts, for identification of the ESB.
5. The contacts shall be gold plated or similarly treated to prevent build-up of resistance in the normally closed contacts.
6. The activation mechanism shall be a break glass latching pushbutton with a diameter of min. 35 mm. The field portion of the reset process of an activated pushbutton will require operation by a key and replacement of the glass. The locks of all ESB shall be identical, i.e. shall be released by the same key. Both the ESB and the control room resets will need to be affected before the system can be restarted.
7. The enclosure shall be min. IP 66 to IEC 60529.
8. The ESB will be double insulated, class 2, or shall be individually earthed for safety.
9. ESB mounted on passenger boarding bridges or other movable constructions will have a vibration- and shock resistance at least 15 gn to IEC 60068-2-6 and 60068-2-27.
10. The ESB enclosure shall have an identification signage with reflective coating for ready identification of the ESB location clearly readable from minimum of 60 meters distance.

Other electrical components and systems are the cathodic protection (***CP***) system(s) – both temporary and permanent, and the leak detection / tightness monitoring system (***LDS***).

The instrument, control or related components included within the scope of this Employer's Requirements are the thermowells and the pressure transmitter nozzles/tapping with respectively installed temperature and pressure transducers to provide relevant instrumentation for control and monitoring.

All E&I cabling (whether power, signal, control) shall tie back to the ESD operating console in the proximity as Instructed by the Employer and/or to local power sources and interface points nearer to Cargo terminal such that others can integrate into the overall SCADA control system at the Fuel Farm (as necessary).

2.8 Typical Requirements

The equipment and materials provided shall comply with the following design criteria:

2.8.1 General Design Criteria

All aspects of the equipment and materials shall conform to standards as specified in this Employer's Requirements, Applicable Laws and rules and regulations prescribed by the Relevant Authority. The Contractor may be permitted to adopt other standards which are not specified herein, if the proposed use of such standards is reviewed without objection by the Employer.

The Contractor shall co-ordinate with the Relevant Authorities including Delhi Fire Service, Delhi Pollution Control Board and National Green Tribunal. In addition, the Contractor shall co-ordinate with the operator appointed by the Employer for the Facility.,

The Contractor shall prepare all relevant information, including drawing submissions, necessary for submission to Relevant Authorities public authorities to enable approvals or certifications to be obtained.

2.8.2 Environment

2.8.2.1 Operational Environment

All equipment and materials shall be designed for minimal maintenance in a hot and humid environment as described herein.

All equipment and materials shall be designed to comply with the requirements of the Contract and to exhibit a high degree of resilience against failure and malicious or accidental damage, consistent with the operational requirements of a large international airport similar to the Airport.

2.8.2.2 General Climatic Environment

All equipment and materials provided under the Contract shall be able to withstand the conditions of transport, storage, installation and operation likely to be encountered in the geographic region of Delhi without physical deterioration or degradation in performance. The Contractor shall determine these conditions and provide the equipment and materials to meet this requirement.

As an absolute minimum, the equipment and materials provided by the Contractor shall comply with all the requirements of this Employer's Requirements for the following climatic conditions:

(a) ambient temperature range: 7.2°C to 50.0°C

(b) average humidity range: 33% to 73%

(c) wind velocities of up to 150 km/hr

(d) rain up to 60mm/hr

(e) condensed moisture may form on some equipment; and materials

(f) climatic designation: humid sub-tropical to hot semi-acrid.

All outdoor equipment and materials shall be capable of withstanding direct solar radiation, which may increase ambient temperatures within enclosures to levels above those indicated herein, without sustaining physical damage and with no degradation of performance.

The environment includes susceptibility to monsoon and therefore all outdoor equipment and materials shall be capable of withstanding wind velocities of up to 150 km per hour and rainfall of up to 60 mm per hour without sustaining physical damage and with no degradation of performance.

All equipment and materials shall be protected against lightning-induced voltage surges occurring on any connected cables and shall sustain no physical damage, except under conditions of direct strike where the particular design measures shall be such as to reasonably minimise any damage incurred. (Note: Lightning flash densities of around twenty (20) flashes per square kilometre per year should be expected.)

All equipment and materials shall be protected against physical deterioration due to high atmospheric and ground salt contents over an effective lifetime of at least fifty (50) years.

All equipment and materials shall be protected against physical deterioration due to moderate concentrations of aircraft exhaust gases, sulphur combustion products, and hydrogen sulphide, within the atmosphere over the effective lifetime or at least fifty (50) years.

All equipment and materials shall be protected against physical deterioration due to the growth of mould. Materials which promote the growth of mould shall not be used in any portion of the equipment and materials.

All equipment and materials shall be sealed against the entry of vermin, insects and other species into equipment and materials housings or enclosures.

2.8.2.3 Indoor Environmental Conditions

All equipment and materials designed for installation inside buildings shall be capable of enduring dry bulb temperatures ranging from 0°C to 45°C with no degradation of performance parameters.

Equipment and systems destined for installation inside buildings shall be capable of enduring the following humidity conditions with no degradation of performance parameters:

(a) Relative humidity: 30% to 99%; and

(b) Moisture formation: condensed moisture may form on internally located equipment.

2.8.3 Codes, Rules and Regulations

All Works and materials shall without limitation comply with all Applicable Laws, rule and regulations prescribed by the Relevant Authority and Good Industry Practice, including the requirement of the following:

- Fire Department
- Electrical & Mechanical Services Department
- Building Authority
- Labour Department
- Environmental Department
- Water Works Department
- Supply Rules of the Power Companies.

Should any Relevant Authority require the submission to them of any part of the Works for approval, testing, stamping or certifying, the Contractor shall submit and deliver such parts to the place required by such Relevant Authority. After such part has been satisfactorily approved, tested, stamped or certified, the Contractor shall return it to Project Site for incorporation into the Works and shall provide the Employer with a copy of the documentation of such approval, test, stamp or certification. It is anticipated, in addition, that fire department will require certification of the post construction pressure test by a registered structural engineer (RSE) or registered professional engineer (RPE). However, the post construction pressure test will also have to be reviewed without objection by the Employer. The criteria the Employer will use to review the pressure test is AS 2885.5 (2012)

2.8.4 General Items

All components and subsystems shall be made by well-established manufacturers with type tested and published performance data, unless otherwise agreed by the Employer.

The Contractor shall be responsible for ensuring that all materials and processes employed in the Works are compatible with each other.

The Construction or installation of proprietary items shall be strictly in accordance with the manufacturers' printed instructions, which shall be copied to the Employer for review prior to commencement of the Works.

The Contractor shall not cut, drill or otherwise alter the work of Related Works unless such alteration has been previously reviewed without objection by the Employer.

All methods, principles and details, for site cutting of components at the Project Site shall be submitted to the Employer as part of the Contractor method statements submitted for approval in accordance with the Background Information.

2.8.5 Fire Proper forties

Where any Relevant Authority requires a specific fire resistance to elements of the structure and these elements form a junction with adjacent components, this junction shall be fire stopped to the same degree as that specified for the element.

The Contractor shall incorporate only materials and products which are approved by and/or acceptable to the Relevant Authorities.

2.8.6 Access and Maintenance

The Contractor shall ensure that the design and the location of all components of the system, equipment and materials that is to be inspected, serviced, operated or maintained in a manner that allows the equipment and materials to be easily accessed for such activities, and shall supply access as required for this purpose.

2.8.7 Sub-Contractors, Equipment and Materials Acceptance

The names of suppliers, manufacturers and sub-contractors of equipment and materials shall be submitted to the Employer for review in accordance with the Contract.

Each item of equipment and materials shall, unless otherwise specified, be the product of an established and reputable manufacturer who has been engaged in the production of similar equipment and materials for a minimum of 5 (five) years unless otherwise reviewed without objection by the Employer.

Where manufacturers' catalogue numbers or types for the components or materials of the equipment and materials are specified in this Employer's Requirements or shown on the Employer's drawings, the Contractor shall compare the duty with the basic duties and performance specified in this Employer's Requirements or shown in the Employer's drawings and submit the results of such comparison to the Employer for review.

All components forming part of the equipment and materials shall be selected such to ensure minimisation of spares and ease of maintenance, and consideration shall be given to those items common to the existing hydrant system.

2.8.8 Fixings

(a) Durability – fixings shall be protected against any corrosion likely to occur in their position of use during the design life of the buildings.

(b) Rigidity – fixings shall be designed to withstand the stresses, movements and vibrations imposed during service.

(c) Appearance – unless otherwise specified in this Employer's Requirements, fixings shall not be visible. Where fixings are visible, their appearance shall match or suit the items being fixed and the element to which they are fixed.

(d) Removability – items which require accessibility or removal shall have suitable fixings.

(e) Avoidance of damage – the method of fixings shall not damage anything being fixed or anything receiving fixings.

(f) The Contractor shall select fixings which in all other respects comply with the requirements of the Contract.

2.8.9 Infestation

The Contractor shall design, manufacture and install the equipment and materials in a manner that ensures that the Works are protected against and do not contain or provide harbourage for infestation by vermin or insects.

2.8.10 Spare Parts

All recommended spares by the material / equipment vendors shall be supplied by the contractor.

The provision of spare parts shall be subject to an instruction by the Employer in accordance with the Contract and Employer's specification.

The Contractor may utilise the stock of spare parts held by the Employer (if any) and shall replace the consumed units within two (2) months of usage or prior to the expiry of the Defects Rectification Period whichever is the earlier.

2.8.11 Tools and Test Equipment

2.8.11.1 General

The Contractor shall provide all tools and special tools and test equipment required for the short- and long-term maintenance of the equipment and materials.

All tools and test equipment supplied by the Contractor under the Contract shall be accompanied by full operation and maintenance instructions, included in the Operations and Maintenance Manuals.

All tools and test equipment shall be subject to demonstration of functionality and performance/calibration checks upon the request of the Employer.

Each tool and item of test equipment shall be supplied complete with its own lockable protective carrying case suitable for protecting the respective item against shock, corrosion, accidental damage, and deterioration in a field environment and during normal cartage.

All tools and items of test equipment shall be accompanied by a suitable certificate of calibration where calibration is appropriate, and shall be subject to inspection and review by the Employer upon delivery to the Project Site.

All tools and items of test equipment shall be supplied prior to testing and commissioning of the equipment and materials and used during testing and commissioning.

2.8.11.2 Tools

Tools shall include:

(a) all general-purpose tools, except tools normally classified as technician's personal tool kits;

(b) all special purpose tools which are required for any aspect of maintenance or operation. Tools required for alignment and adjustment shall also be provided; and

(c) all necessary jumpers, connectors and cables required to interface the test equipment and tools to the equipment and materials being tested.

Any tools which are not supplied for the testing and commissioning of the equipment and materials but which are found to be necessary by the Employer during the Defects Rectification Period shall be provided by the Contractor.

2.8.11.3 Test Equipment

Test Equipment shall include:

(a) all general-purpose test equipment including multi-meters and meggers;

(b) all special purpose test equipment required for test, measurement, alignment and repair of all equipment materials and the system.

(c) all system support required for maintenance and modification of software.

Any test equipment which is not supplied for testing and commissioning of the equipment and materials but which is found to be necessary by the Employer for maintenance of the equipment and materials during the Defects Rectification Period shall be provided by the Contractor.

2.8.12 Inspection, Testing and Commissioning

2.8.12.1 General

The equipment and materials shall be inspected, tested and commissioned to confirm that the equipment and materials performance complies with the requirements of the Contract, Applicable Laws, rules and regulations, prescribed by the Relevant Authority and Good Industry Practice.

All such inspection, testing and commissioning shall, in particular but without limitation, be planned, carried out and documented in accordance with:

(a) the Contract;

(b) the Employer Requirements, MTO, Layout and Hydraulic Analysis;

(c) the Applicable Laws, rules and regulations, prescribed by the Relevant Authority and Good Industry Practice;

(d) Approved methods, Standard Operating Procedures (SOPs), principles and details;

(e) the construction quality plans and inspection and test plans prepared by the Contractor in accordance with the relevant ISO standard and reviewed without objection by the Employer; and

(f) this Employer's Requirements.

2.8.12.2 Terminology

In this Contract (unless otherwise defined), and in all programmes, quality plans, reports and other documents produced in the course of this Contract and execution of Works, the following terms shall be used:

(a) Manufacturing Phase - the period during which the manufacturer, fabricator or assembler of the equipment and materials, or any single element of the equipment and materials, is carried out off-Site;

(b) Installation Phase - the period during which the fabrication, assembly and installation of the equipment and materials, or any single item of the equipment and materials, is carried out on-Site;

(c) Pre-Commissioning Phase - the period when, in relation to the equipment and materials or any single item of the equipment and materials component tests s and commissioning are carried out in preparation for the equipment and materials Commissioning Phase;

(d) System Commissioning Phase - the period when Commissioning and reliability Tests are carried out to ensure that the system fully complies with the design and operational requirements of this Contract;

(e) System Integration Phase - the period prior to issue of the Completion Certificate when system integration Tests and Commissioning are conducted to integrate the system with all work completed or being undertaken by Related Works in full compliance with the design and operational requirements of this Contract;

(f) Confidence Trial Phase - the period after issue of the Completion Certificate when the confidence trials are carried out;

(g) Phase - one or other of the phases identified in (a) - (f) above;

(h) Type Tests - tests undertaken on similar equipment or components in lieu of individual unit tests;

(i) Factory Tests - tests carried out on items of equipment and materials at the manufacturer's works or elsewhere before they are dispatched to Project Site;

(j) Site Tests - tests on static items of equipment and materials and systems (e.g. inspection and testing of welds and hydraulic testing of piping and pipeline works) to ensure correct and safe installation before setting to Work;

(k) Component Tests - tests on components to be incorporated in the equipment and materials;

(l) Commissioning - the advancement of the equipment and materials or any single element of the equipment and materials from the stage of static completion to full working conditions and to meet the specified design requirements. This shall include Setting to Work and regulation;

(m) Setting to Work - the process of setting a static system into motion;

(n) System Integration Tests - the measuring, recording and providing of correct integration between the equipment and materials and all other systems installed by Related Works as detailed in the Employer's Requirements;

(o) Regulation - the process of adjusting a system (e.g. the rates of fluid flow and heat transfer in a distribution system) within specified tolerances;

(p) Reliability Tests - tests carried out over a set trial period and under simulated operation conditions to prove reliability;

(q) Deferred Seasonal Tests - tests conducted at certain times of the year to suit seasonal climatic conditions;

(r) Confidence Trials - tests undertaken during the Confidence Trail Phase when the system is operated by the Employer under the supervision of the Contractor;

(s) Inspection, Testing and Commissioning Programme - means the sub-network of the Works Programme prepared by the Contractor and reviewed without objection by the Employer, detailing the programme for the inspection, testing and Commissioning of the Works;

(t) Phase Notice - a notice prepared by the Contractor in accordance with the requirements of this Employer's Requirements;

(u) Phase Report - a report prepared in accordance with the requirements of this Employer's Requirements.

(v) Test Results Form - a form prepared in accordance with the requirements of this Employer's Requirements.

The Contractor shall detail all the above mentioned in the Testing Plans to be approved by the Employer pursuant to the Contract.

2.8.12.3 Testing and Commissioning Phases

In order to facilitate the orderly management of the testing and Commissioning of the system, equipment and materials and the Employer's monitoring of the progress of the Works as a whole, the Contractor shall structure his construction quality plans, inspection and test plans and the inspection, testing and commissioning programme into the following Phase with the tests to be carried out during each Phase identified under the following categories:

(a) Manufacturing Phase:

- Factory Tests; and
- Type Tests.

(b) Installation Phase:

- Site Tests.

(c) Pre-Commissioning Phase:

- Component Tests and
- Commissioning of elements of the equipment and materials

(d) Equipment and Materials Commissioning Phase:

- Integration of elements of the equipment and materials;
- Commissioning; and
- Reliability Tests.

(e) Equipment and Materials Integration Phase: and

- equipment and materials Integration Tests

(f) Confidence Trials Phase.

Any Deferred Seasonal Tests shall also be clearly identified in all plans and programmes and shall be included in the Testing Plans to be approved by the Employer.

For the duration of the Defects Rectification Period operational and safety controls shall be sealed if adjustment beyond defined limits could result in malfunction and give rise to a defect.

The Contractor shall provide attendance and technical support during the confidence trials period in accordance with the Employer's Requirements.

2.8.12.4 Quality Assurance Plans or QA/QC Plans

The Contractor shall identify in his construction quality plans any division of the equipment, materials and system into discrete elements to facilitate the preparation and service of Phase Notices as called for in this Employer's Requirements.

In addition to the requirements of the Contract, each inspection, testing and commissioning plan shall include:

(a) details of the skills and previous experience of the personnel responsible for inspection, testing and Commissioning;

(b) details of the type and number of instruments to be used and the relevant calibration certification;

(c) lists of items of equipment and materials and systems to be inspected, tested and Commissioned including identification of sub-systems;

(d) schedules identifying each inspection, test and Commissioning activity which must be satisfactorily completed in each Phase;

(e) details of use of utilities in terms of timing, capacity and duration of use;

(f) details of the interdependence of the inspection, testing and Commissioning process with the performance or provision of Other Contractor's systems;

(g) details of any required attendance by and assistance from other parties, including the Employer, Relevant Authorities and Related Works.

(h) detailed Commissioning procedures, methodology, and phasing to be adopted to achieve successful Commissioning of the Works;

(i) details of simulators, test rigs or load banks to be employed;

(j) lists and quantities of any consumables that will be required and supplied by the Contractor up to substantial completion of the Work; and

(k) details of any external Commissioning expertise or independent testing and certifying organisation that may be used.

The Employer, in reviewing any inspection and test plan, may require additional inspection, testing and commissioning documentation as may be considered reasonably necessary to record these processes.

2.8.12.5 Phase Notices

For each element of the equipment and materials identified in the Contractor's construction quality plans or, as the case may be, for the system as a whole:

(a) the Contractor shall prepare and submit to the Employer for review a Phase Notice at the end of the Manufacturing Phase, the Installation Phase and the Pre-Commissioning Phase;

(b) each Phase Notice shall contain a statement by the Contractor confirming that all inspections and tests required during the relevant Phase have been performed satisfactorily or identifying any non-conformities or tests that have been failed and confirming that all reports of such inspections and tests have been filed in his records office;

(c) the Phase Notice relating to a Manufacturing Phase shall confirm that the Contractor is satisfied that the relevant equipment or system or part of a system is ready for release from the manufacturer's works;

(d) the Phase Notice relating to an Installation Phase shall confirm that the Contractor is satisfied that the equipment or system or part of a system is ready for starting the pre-Commissioning tests; and

(e) the Phase Notice relating to a Pre-Commissioning Phase shall confirm that the Contractor is satisfied that the system or part of a system is ready for Commissioning and Reliability Tests.

Upon receipt of an application for a Completion Certificate or Stage Certificate, the Employer may carry out a detailed inspection of each element of the system in the presence of the Contractor to check the soundness and state of the system and identify the extent of any rectification work required. The Contractor shall ensure that, prior to such inspection, all work has been properly and thoroughly cleaned, painted where specified and generally tidied up to present a clean and workmanlike installation.

The Contractor shall ensure that all the above mentioned are noted in the Testing Plans and that the Testing Plan integrates the requirements of the testing procedures during various Phases as identified in these Employer's Requirements.

2.8.12.6 Test Results Forms

In addition to the requirements of the Particular Specification, each report of an inspection or test shall indicate the following:

(a) the system or item being tested;

(b) the identification reference for an item being performance tested;

(c) the test acceptance criteria;

(d) the tolerances;

(e) the test units of measurement;

(f) the actual test results;

(g) pass/fail;

(h) whether a concession will be requested;

(i) any concessions or variations made; and

(j) whether a design review is requested.

Test acceptance criteria shall be prepared by the Contractor in accordance with the Employer's Requirements and included as part of each test results form. Acceptance criteria may not be changed by the Contractor except with the consent of the Employer in writing.

The Contractor shall prepare and submit the proposed test results forms as part of his submission of the relevant Inspection, Testing Plans.

2.8.12.7 Phase Reports

Without prejudice to the Contractor's obligations to produce summaries of test data and other information under the Contract, the Contractor shall upon completion of each Phase complete and submit to the Employer for his information a Phase Report setting out and detailing the test results including performance figures obtained, graphs, charts tabulated computer output, and supporting narratives describing any special events, occurrences and other discrepancies or deviations not expected in the original plan or programme.

In particular, the Phase Report shall include a chronological diary of findings and incidents including:

(a) workmanship;

(b) System operating peculiarities and observations;

(c) Any measurement and checks which may be required by operating and maintenance personnel; and

(d) Results of any statutory testing and inspection, e.g., earth grid measurements.

All hazardous conditions shall be corrected by the Contractor prior to or during Commissioning. Comments shall be included on any observed deficiencies in equipment, materials and system design and performance.

Any modifications to circuitry, instrumentation, etc. carried out at any time shall be recorded in detail in the Phase Reports and shown on the As-Constructed Drawings.

Any conclusions that would be helpful to the Employer's operating and maintenance staff shall be summarised at the end of the Phase Reports.

The Phase Reports shall be prepared and submitted in the Employer's standard format as soon as practicable after the completion of each Phase.

2.8.12.8 Standards and Regulations

All testing and Commissioning carried out by the Contractor shall be undertaken using the International System of Units (S.I.) and shall comply, as appropriate, with the latest and most up to date edition at the time of Notice to Proceed, of the following standards, regulations and guides:

(a) the relevant "British Standard Codes of Practice" or "British Standard Specifications" where applicable to the Works published by the British Standard Institution;

(b) the 18th Edition (2019) of the Regulations for electrical installations issued by the Institution of Electrical Engineers (U.K.); - now the IET.

(c) "Code of Practice for inspections and testing of installations and equipment" published by Government of India

(d) "Code of Practice for Electricity (Wiring) Regulations" published by Government of India;

(e) "Code of Practice for minimum fire services installations and equipment" published by Government of India;

(f) relevant bulletins and information issued by Fire Department;

(g) Other standards as called up in the specification or Prescribed by the Relevant Authority

2.8.12.9 Contractor's Testing and Commissioning Staff

All testing and Commissioning shall be undertaken by the Contractor's appropriate testing and Commissioning specialist or by a competent independent Commissioning specialist nominated by and acting for the Contractor and reviewed without objection by the Employer.

The Contractor shall provide all necessary skilled labour and assistance for testing, operating, adjusting, Commissioning and verifying the performance of all equipment and materials and the system.

The Contractor's testing and Commissioning staff shall have had previous experience with testing and Commissioning similar equipment, materials and systems of comparable duty.

The Contractor's relevant specialist testing and Commissioning staff including supervisors shall be available on Project Site at all times during testing and Commissioning of the equipment, materials and system.

2.8.12.10 Testing and Commissioning - Equipment and Instruments

The Contractor shall provide all portable and supplementary instrumentation, recording facilities, consumables and the like required for all Factory Tests and Testing and Commissioning on Site.

Testing and Commissioning instrumentation shall be designed for field use and to minimize field measurement errors through the use of electronic sensors, digital displays and similar devices.

The calibration of instruments shall be demonstrated immediately prior to, and after completion of Testing and Commissioning, and current calibration certification submitted to the Employer for record purposes.

At least one complete set of Testing and Commissioning instrumentation, including all accessories, fittings, attachments and purpose-built carrying cases, shall be made readily available in a calibrated and operational condition for retesting by the Contractor for the duration of the Defects Rectification Period.

The end to end accuracy of instrumentation shall be verified in accordance with the recommendations of ASHRAE Guideline 13.

2.8.12.11 Notifications

The Contractor shall give the Employer notice in writing when tests or trials will be ready to commence. Not less than 48 hours' notice of all tests and trials carried out on Project Site shall be given.

2.8.12.12 Inspection and Testing

Prior to any inspection and testing by the Employer, the Contractor shall inspect and test the equipment and materials or any part thereof himself to ensure that equipment and facilities are clean and complete and can reasonably be expected to meet successfully all inspection and/or testing criteria.

Prior to Testing and Commissioning, the Contractor shall clean all the equipment and materials and shall confirm in writing to the Employer that all relevant work by Related Works Contractor is complete and satisfactory for the purpose of Testing and Commissioning.

In the event that the Contractor considers that any testing is not appropriate or required, the Contractor may submit alternative proposals to the Employer for his review.

3 Specific Requirements

These instructions are an augmentation of requirements under the prevailing standards and codes, and reflect experience in the specific discipline of works. Where there is a conflict between these instructions and prevailing standards and codes, the most stringent in the opinion of the Employer shall apply and as clarified by the Employer to the Contractor.

3.1 Civil Works

3.1.1 General

All Civil Works shall be carried out by Hydrant Contractor. This section 3.1 should be read in this context.

Pre-survey is mandatory. Cable detection to be confirmed (mandatory) for underground services using Ground Penetrating Radar (GPR). GPR is mandatory. Excavation permit from Employer and the Relevant Authority as per Applicable Laws must be obtained and be valid.

3.1.2 Hydrant Trench Works

Trenching made by main works contractor shall be checked by hydrant works contractor who shall confirm that it is according to the requirements of hydrant works contractor.

Excavated materials shall be removed and this includes proper disposal from Project Site.

Backfill to be granite dust for hydrant lines up to the subgrade level. The backfill shall be properly compacted and consolidated in layers of 200 mm up to the finished level at 95% AASHHO density. The rest (subgrade and concrete slab) shall be as per Employer's Requirement. Refer to drawings for Standard Trench Detail.

The trench shall be designed and checked by a qualified person at Contractor's cost in compliance with Applicable Laws, rules and regulations, prescribed by the Relevant Authority and Good Industry Practice. Shoring and strutting are required for trenches more than one metre in depth. All shoring protection requirement shall be in accordance with Applicable Laws, rules and regulations, prescribed by the Relevant Authority and Good Industry Practice.

3.2 Fabrication and Installation of Piping and Pipework

3.2.1 General

This section of this volume of Employer's Requirements covers the storage or materials, fabrication and installation of aviation fuel piping.

For the avoidance of doubt all welding shall be completed prior to pressure test, and if welding of any pipe section is required post-pressure test another complete pressure test of that section shall be carried out to the satisfaction of the Employer.

Pipe work installation shall only be performed against a Employer-approved execution plan, and in accordance with Employer-approved procedures and method statements. Hydrant System shall be constructed in a manner for pressure testing using jet fuel as the test medium.

All line pipe and fittings shall be stored by laying on suitable supports such as sand bags etc., plugging the ends with plastic caps and storing off the ground in a secure covered storage area. A single stack of pipes is preferred, but the maximum height of the stack is to be three pipes. Before removing pipe from the stack on site, each item shall be subject to a visual inspection for damage to internal and/or external coating and repaired as necessary. Internal protective coating on valves shall be completely removed before installation.

Preservation of internal pipe cleanliness and internal coating integrity shall be a prime objective. Dirt and moisture contamination shall be avoided by strict adherence to procedures. Open pipe ends shall be securely end-capped sufficient to prevent the ingress of dirt and/or water when not being worked on. Fully effective means to prevent the ingress of dirt and/or water are available and therefore Contractor shall be fully liable for any dirt and/or water found inside installed piping, for removing such dirt and/or water, for making clean and good to Employer satisfaction and for any consequent delays including to the Related Works Contractor.

Maintaining external pipe coating integrity shall also be a prime objective. Pipe storage and handling shall be carefully managed to avoid coating damage.

Field joint coating and coating repair shall only be performed by qualified personnel and shall be tested using approved test equipment operated by qualified personnel.

Flange faces shall be protected to avoid damage.

Flange make up shall avoid over stressing and approved bolt tensions or bolting torque figures shall not be exceeded.

In order to avoid unnecessary stress to valve castings from pipe fit up, in general construction shall proceed away from valves in valve chambers as opposed to towards valves in valve chambers. Avoidance of unnecessary/excess stress to valve castings shall be a particular consideration and Employer will inspect Works accordingly.

Ball valves shall be stored and installed in the open position to avoid damage/contamination of the ball face.

Gate and globe valves shall be stored and installed in the closed position to avoid damage to seating/sealing faces.

Piping should be fabricated and installed in a logical sequence. Fit up and tie in of new pipe work into the existing system shall be performed in accordance with a dedicated method statement.

Tie-ins shall be carefully planned and executed.

Welding shall only be performed by current coded welders in the necessary pipe diameters and as a minimum the 6G position in accordance with the relevant code.

All permanent welds shall be subject to as a minimum 100% radiographic examination as per the relevant code.

All materials and equipment permanent or temporary shall be aviation fuel compatible and these shall be approved for use by Employer.

All lifting works shall comply with Applicable Laws, rules and regulations, prescribed by the Relevant Authority and Good Industry Practice. All lifting works shall come with the method statement and the associated risk assessment for the works. All lifting works shall come with a lifting plan that shall be reviewed by the Employer. All lifting equipment shall come with valid certificates.

All pipe work shall be subject to pressure test using Jet A-1 as the test medium. Employer shall provide the medium and Contractor shall provide manpower to assist on this operation. In case of any loss of Jet A-1 fuel due to negligence and/or contamination attributable to Contractor, cost of fuel provided by Employer to the Contractor shall be reimbursed to Employer.

The same provisions herein shall apply to all and any other uses of Jet A-1 for the hydrant works with respect to hydrant works contractor's liability in case of any loss of Jet A-1 fuel due to negligence and/or contamination attributable to hydrant contractor, in which case cost of fuel provided by Employer to Contractor shall be reimbursed to the Employer.

3.2.2 Pipe Cutting and Welding Edge Preparation

3.2.2.1 Method

Pipes shall be cut either by mechanical means or by thermal cutting.

End levelling shall be done by machining, hand grinding or machine flame cutting.

Where thermal cutting is employed, all slag, oxides and traces of previously melted metal shall be removed from welding edges by grinding or machining to sound metal.

The preheat level to be used for thermal cutting shall be as required by welding procedures developed in accordance with ASME boiler and pressure vessel code, Section IX or other

The bevel geometry shall be the same as and within the tolerances stated in the welding procedures which shall have been reviewed without objection by the Employer.

All holes less than 40 NS for branch lines to be drilled.

3.2.2.2 Inspection

After the material has been prepared for welding it shall be visually examined to confirm the surface within 25mm of the bevel edge is smooth and uniform, free from cracks, tears, laminations, gouges and any other discontinuities which may affect the integrity of any weld. If there is any indication of defects the weld preparation area shall be subjected to surface crack detection. Where any defects are found the weld bevel shall be re-prepared and re-examined by the Contractor at its own cost and risk.

3.2.3 Pipe Bending

3.2.3.1 General

Unless otherwise specified on Employer's drawings bends in piping shall be achieved using standard fittings in accordance with ANSI B16.9 (3D Std Bends)

Where bending is required this shall be performed by the hot induction method by an approved contractor/ supplier and be carried out in accordance with ANSI B31.4 in the Contractor's workshop. No bending shall be allowed to take place on Project Site. The bending and heat treatment procedures proposed by the Contractor shall have been reviewed without objection by the Employer. Test bends will be required to be done.

The induction bend centre line radius shall be five (5) times the nominal pipe diameter unless otherwise stated on the Employer's drawings

Pipe bend shall be fabricated using seamless pipe and shall have no girth welds.

Bends shall not be wrinkled, cracked, scratched, gouged, die marked or buckled and shall be in one plane.

Weld repair of pipe bends shall not be permitted.

So-called "cut and shut", creased or corrugated bends shall not be used.

3.2.3.2 Mitre Bends

Mitre bends shall only be used as permitted by ASME B31.4 and only for Temporary Works.

Mitre bends shall be produced by butt welding together segments cut from the same length of pipe. The maximum change of direction between adjacent segments shall be three (3) degrees.

3.2.4 Flanged Joints

3.2.4.1 General

Flange bolt holes shall straddle the vertical centre line (i.e. 2-hole top), except where otherwise specified on the Employer's drawings, and shall match the orientation of the mating flanges.

Pipe ends connected to threaded flanges shall not project through to form part of the gasket surface. In general, threaded flanges and threaded joints are not envisaged and are hereby discouraged.

No flanges are permitted underground unless situated in a purpose designed enclosure (pit box or valve chamber).

3.2.5 Installation

3.2.5.1 Flanged Joints

Flanged faces shall be cleaned of all dirt, grease and protective coatings and shall be inspected for defects such as scratches or dents prior to connection.

Flanges shall be properly aligned prior to the insertion of gaskets and bolts to avoid stresses or uneven gasket loads.

Where specified, bolts shall be tightened by means of suitable torque wrenches or tensioning devices to ensure the correct bolt stress is obtained and the gasket is properly compressed in accordance with the design principles applicable to the gasket type. Hammering of wrenches shall not be permitted.

All bolts shall extend completely though their nuts by 2-3 threads only. The use of washers or spacers to take up excess bolt length shall not be permitted.

Flange covers shall not be removed from equipment flanges until ready to connect the mating piping.

Connections to strain-sensitive equipment shall not be made until the mating piping has been fully erected complete with permanent supports. Prior to bolting up to the equipment flange, the connection shall be checked for correct alignment.

3.2.5.2 Threaded Pipework

Pipe ends cut shall be cut square, threaded, reamed and cleaned to remove cuttings from internal and external surfaces. All threading shall be carried out after bending, forging or heat treatment except where this is impossible in which case suitable thread protection shall be provided. All threaded connections shall have taper threads in accordance with API unless otherwise stated.

All joints shall be tightened to specified torque using suitable wrenches. Connections on DN50 and larger shall be tightened using a 'RIGID compound leverage pipe wrench' or equivalent. Pipes and fittings shall not have excessive wrench markings. Hammering of wrenches shall not be permitted.

The joints shall be assembled using a suitable petroleum resistant pipe jointing compound which shall be applied to the male thread only, taking care to ensure the compound does not reach the inside of the pipe. Jointing compounds shall be suitable for use with Jet A-1 and details shall be submitted for review and approval by the Employer prior to their use.

3.2.5.3 Pipe Supports

Where pipe supports are required to be welded to the pipe, as specified in the Employer's drawings, this shall be carried out during the fabrication of the pipe spool, with the exception of pipe support shoes which are generally welded during installation.

The Contractor shall ensure there is adequate field fit margin in the pipe supports to allow the piping to be installed without forcing.

The burning of holes in structural steelwork or component parts will not be permitted.

Adjacent structural elements or equipment shall not be used as temporary supporting or lifting attachments.

Metallic surfaces of supports which will be inaccessible after erection shall receive a protective coating before assembly in accordance with the Painting and Coating Specifications detailed elsewhere in this document.

Pipe reinforcement pads on supports, anchors, etc shall be provided with one hole (at the side and not at the crotch) drilled and tapped 1 /4" NPT.

3.2.5.4 Bolting

The Contractor shall provide all stud bolts, nuts etc. All stud bolts shall be the correct length to ensure that all thread on nuts are engaged and that the end of the stud bolt does not project more than 3mm from the upper face of the nut when tightened.

3.2.6 Stainless Steel Piping and Fittings

3.2.6.1 Piping

Materials shall be in accordance with ANSI Type 316 Grade 18/8. Austenitic Stainless Steel, clean smooth and free from scratches to ASTM A-269 or equivalent.

3.2.6.2 General

Field run piping shall be run generally in accordance with the routing indicated on the Employer's drawings, in a neat and orderly manner consistent with good operation, safety of personnel and economy of material.

3.2.6.3 Connections

All joints, except where butt welded to change from tube, shall be gauge cable double ferrule compression tube fittings in 316 stainless steel Swagelok or equivalent, complete with gap inspection gauge. A thread sealant shall be applied when assembling threaded fittings, liquid PTFE or equivalent.

For welded stainless steel joints, tested weld procedure specifications and welders qualified to those procedures are required.

3.2.7 Painting

Pipework within valve chambers shall be primed with one coat and painted with two coats of aviation fuel resistant paint which has been reviewed without objection by the Employer.

3.3 Welding of Pipelines and Fittings

3.3.1 Prerequisites

3.3.1.1 Scope

This section of this volume of Employer's Requirements relates to the field welding of carbon steel pipelines carrying Petro-chemical products.

3.3.1.2 Prefabricated Pipework

Prefabricated pipework shall be welded in accordance with the requirements of ASME B31.4, and API 1104 (21st edition).

3.3.2 Supply and Storage of Materials

The Contractor shall include all the necessary welding equipment, flux, gas, filler metal and testing equipment required for the Works. The Contractor shall unload (including uncrate and unpack), physically handle and transport, all materials and equipment to be installed. Electrode baking oven and electrically heated quivers are also required. For the avoidance of doubt a weld shall be rejected if it is found to have been made where electrode baking or maintenance of electrode heat were not per requirements

3.3.3 Line Welding

3.3.3.1 General

The field welding of end to end butt joints in pipelines shall be carried out in accordance with the requirements of API Standard 1104 except insofar as they are qualified by the provisions of this specification and any statutory regulations.

3.3.3.2 Scope

Line joints shall be welded by the manual metal arc process using covered electrodes, or as otherwise approved, but with TIG root.

3.3.3.3 Welding Procedure Specification

The Welding Procedure Specification as defined in API Standard 1104 shall be reviewed without objection by the Employer before the Procedure Qualification Tests are conducted. If repairs are to be undertaken, repair procedure specifications are to be available. If repair on repair is to be undertaken, repair on repair procedure specifications are to be available.

Note the existing hydrant has been welded with a TIG root and a TIG root is required for the extension works.

3.3.4 Testing and Inspection

All materials and workmanship shall be of the respective kinds and Standards described in the Contract and in accordance with the Employer's Representative's instructions and shall be subjected from time to time to such tests as provided for in the Testing Plans and the Contract. The Contractor shall provide such assistance, instruments, machines, consumables and artificial loads and labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the Works for testing as set out in the Testing Plans or as may be selected and required by the Employer's Representative.

3.3.4.1 Welding Procedure Qualification

The Contractor shall give notice to the Employer when the welding procedures tests and welder qualification tests are to be conducted.

For pipe, separate procedure qualification tests shall be performed for each grade of material, diameter and wall thickness. No grouping will be permitted.

3.3.4.2 Qualification of Welders

Fillet Welds – Scope of Qualification

A welder qualified to fillet weld an outlet which has a nominal diameter of at least 50 per cent of the nominal diameter of the run may be considered qualified to make any fillet welds by the same process in which he qualified and may be considered qualified to weld branch connections in the following positions: -

(a) All positions, if the qualifying weld was made with the branch connection on the bottom of the run.

(b) Top and side, if the qualifying weld was made with the branch connection on the side of the run.

(c) Top, if the qualifying weld was made with the branch connection on the side of the run.

Positional Welding

The fixed position of the pipe in which a test weld is made shall determine the extent of qualification of the welder as follows: -

(a) To qualify to weld in a fixed position within 20º of the horizontal

The test weld shall be made between pipes fixed horizontally.

(b) To qualify to weld in a fixed position within 20º of the vertical

The test weld shall be made between pipes fixed vertically.

(c) To qualify to weld in a fixed inclined position between 20º to 70º to the horizontal

The test weld shall be made between pipes fixed at angle of 45º to the horizontal.

Qualification by Radiographic Examination – Butt Welds Only

Preference will be given to the quality assessment of welders' test joints by radiographic examination. Destructive testing shall be used for examining butt welds if radiographic examination is not possible.

Qualification by Mechanical Test – Butt Welds Only

When the Employer's consent is obtained to assess the welder's test joints by destructive testing, tensile test will not be required.

3.3.5 Standard of Acceptability

3.3.5.1 Porosity

The total area of porosity, projected radially through the weld shall not exceed 1% of the projected weld area, equal to three pores 1.5mm diameter. No single pore shall exceed 1.5mm diameter for wall thickness 6 mm and over, or 0.8mm diameter for wall thickness less than 6mm.

3.3.5.2 Cracks

No cracks or crack-like defects will be permitted.

3.3.5.3 Accumulation of Discontinuities

In addition to the requirements of API Standard 1104, the length of individual defects such as slag inclusions, incomplete fusion, internal concavity shall be included for the purpose of determining acceptable limits.

3.3.6 Repair or Removal of Defects

3.3.6.1 General

The Employer's Representative shall have the right, but not the obligation, to instruct the Contractor in writing, to execute all such work of repair, replacement, amendment, reconstruction, rectification and make good defects, imperfections or other faults in the Works and/or any part thereof, as the case may be, in accordance with the Contract and these Employer's Requirements, either as a result of an inspection made by or on behalf of the Employer's Representative or as otherwise comes to the knowledge of the Contractor. For the avoidance of doubt, the Contractor's obligations shall also apply to any damage to any Related Works caused by the Contractor. Any such rectification and repair shall be carried out in accordance with the Contract read with these Employer's Requirements. The Employer shall be entitled to require testing of any repair, rectification, replacement or alteration, at the Contractor's cost. If such test fails, the repair, rectification, further

replacement, reconstruction or alteration shall be carried out and the tests shall be repeated till the tests are passed.

When re-welding, the weld metal shall be similar to that used in the original joint.

Pre-heating and post weld heat treatment shall be similar to that specified in the welding procedure for the original weld.

Defects shall be removed by chipping, grinding, machining or thermal gouging, or entire welds shall be removed by thermal cutting.

Entire removal of a weld involves either cutting through the weld or cutting out a length of pipe containing the weld. When thermal gouging or thermal cutting is used, the last 6mm through the root of the weld shall be removed by mechanical means.

3.3.6.2 Preparation of Re-Welding

No weld shall be repaired without the consent of the Employer. If the repair is made as a consequence of the results from non-destructive testing, the records showing the original defects shall be submitted to the Employer for review and approval of further Works.

3.3.6.3 Partial Removal of Weld

The cut-out portion shall be sufficiently deep and long to remove that defect. At the ends and sides of the cut there shall be a gradual taper from the base of the cut to the surface of the weld metal. The width and profile of the cut shall be such as will give adequate access for re-welding. When the root of the weld is accessible from the bore of the pipe, a repair to the root may be made from that position.

3.3.6.4 Complete Removal of Weld

Where a cut has been made through a faculty weld and there has been no serious loss of pipe length, the weld preparation shall be remade in accordance with the requirements of this Employer's Requirements.

Where a length of pipe containing a faulty weld has been removed, a new length of pipe not less than one diameter in length shall be inserted and the two joints shall be prepared in accordance with the requirements of this Employer's Requirements.

3.3.7 Detail Requirements

3.3.7.1 Welding Electrodes

All welding electrodes shall comply with BS.EN 499 (1995).

3.3.7.2 Electrode Packaging

In cases where electrodes have to be shipped by sea from their country of manufacture to their point of use, they shall be packed in tin plate boxes having a soldered-on lid and weighing not more than 25 kg. The boxes shall be packed in wooden cases lined with bitumen/kraft paper.

3.3.7.3 Mill Bevel

Pipe shall be provided with the ends levelled to an angle of 37½º±2½º.with a root face of 1.5mm plus or minus 1mm.

3.3.7.4 Field Bevel

When pipe ends are levelled in the field, this operation shall be done by machining, using a floating heat cutter or by machine oxygen cutting, manually operated and using a floating head. The angle bevel shall not be less than 35º.

Manual oxygen cutting shall not be used for levelling the ends of pipe work welding unless it is impracticable to use matching or machine oxygen cutting equipment.

3.3.7.5 Tie-in Welds (Closing Welds)

All tie-in welds shall be visually and radiographically inspected. Ultrasonic testing is required to extend 100mm of cut positions. Tie-in pipe pieces and temporary test ends shall be pretested to the test pressure prior to commencing tie-in work. Tie-ins and special fittings shall be welded in the pipe by the uphill method.

3.3.7.6 Alignment of Longitudinal Seams and Proximity of Welds

The longitudinal welded seams in adjacent lengths of pipe shall be offset by a minimum of 15º. Longitudinal seams shall be within the top half of the pipe circumference.

Where possible, branches, fittings and attachments shall not be located on or near circumferential or longitudinal welded seams in the main pipeline. Where this is unavoidable the Contractor shall submit all design documents considered necessary by the Employer, and the Contractor shall obtain a notice of no objection from the Employer with respect to the location of such branches, fittings and attachments in accordance with the Contract.

3.3.7.7 Alignment and Field Rectification of Pipe Ends

The ends of proprietary pipes and fittings will be supplied to standard tolerances and may not match, especially if placed together at random. All pipe ends shall be securely clamped prior to welding. In addition, the following may be necessary.

The type of clamp to be used shall be shown to be capable of removing out of roundness permitted in pipe manufacture to within the tolerance permitted in API Standard 1104.

The alignment of abutting pipe ends shall be such as to minimise the offset between surfaces and allow for contraction during welding, and nowhere shall the pipe be sprung in place.

Any misalignment shall be reduced to a minimum by rotation of the pipes to obtain the best fit.

Cold dressing shall only be used in cases of slight misalignment and any hammering shall only be carried out using a bronze headed hammer. Hot dressing shall be used for correcting excessive misalignment. Review without objection by the Employer is required for such procedures.

For pipes of the same nominal bore, the offset between the surfaces of abutting pipe ends shall not exceed 1.5mm before commencement of welding.

For pipes of different nominal bore and the same outside diameter, the smaller bore shall be machined, ground or filed to give the above alignment with a taper not steeper than 1 in 4 . Alternatively, a transition piece shall be inserted that satisfies the same requirements.

3.3.7.8 Field Rectification of Pipe Ends

Damaged ends of pipes shall be repaired, also the pipe ends shall be checked dimensionally and rectified where necessary to ensure compliance with the maximum misalignment tolerance of 1.5mm. These operations shall be completed prior to the pipes being required for assembly and welding.

3.3.7.9 Removal of Line-up Clamps

The line-up clamps shall be held firmly in position until the root run (stringer bead) is completed and the pipe has been supported properly. The second run of weld metal (hot pass) shall be applied immediately before connecting the next pipe to the string.

An external clamp shall not be removed until the completed part or the root run covers a minimum of 50% of the circumference of the joint uniformly spaced, the pipe remaining adequately supported on each side of the joint. When external clamps are used the uphill method of welding shall be used for root runs.

3.3.7.10 Bevel Surface Condition

The levelled profiles and bores at the ends of pipes shall be cleaned by power driven wire brushes and/or grinders before welding for a minimum distance of 25mm from the prepared edge on both the inside and outside of the pipe.

3.3.7.11 Filler and Final Runs

The requirements of API Standard 1104 shall be met except that the depth of the weld reinforcement shall not be less than 1mm nor more than 3mm.

At the completion of the day's work all welds that have been started shall be finished.

3.3.8 Branches and Fittings

3.3.8.1 Branches

The lengths of flanged branches shall be such that there is adequate access for satisfactory welding.

3.3.8.2 Joint Preparation

Branch connections and branch openings in the main pipe shall be cut by machining or by thermal cutting except that all holes 40mm and less shall be drilled as specified elsewhere in this Employer's Requirements. The cut edges shall then be dressed by chipping, filing or remove any roughness and to produce the specified edge shape.

Protective coatings on end bevels shall be removed before welding. The method of removal shall be reviewed without objection by the Employer.

3.3.8.3 Branch Reinforcement

No Branch Reinforcement is envisaged.

3.3.8.4 Fittings

All fittings shall be back chipped and welded from the inside.

3.3.9 Workmanship

3.3.9.1 Inter-run Cleaning

Each run of weld metal shall be thoroughly cleaned, either by hand or power tools, before a further run is applied.

Visible defects such as cracks, cavities and other deposition faults shall be removed and particular attention paid to the cleanliness of the junctions between the weld metal and the fusion faces before deposition of further weld metal. Deposited metal shall be properly fused with the parent metal at all parts. Clusters of surface porosity, stops and starts and high points shall be removed by grinding.

3.3.9.2 Stray Arcs

Arcs shall only be struck on fusion faces and accidental contact of the electrode or of the non-insulated parts of electrode holders with the outer surface of the pipe shall be avoided. An earth saddle making good electrical contact with the pipe shall be placed convenient to the weld for dabbing the electrode where this is necessary for removing slag from the tip or to facilitate the starting of the arc. Electrode holders shall be of the fully insulated type. The Employer shall determine whether the stray arcs are to be removed or repaired.

3.3.9.3 Tack Welds

Tacks which are to be incorporated in the final weld shall be thoroughly cleaned of slag and suitably prepared at each end by means of grinding to ensure complete root continuity. All tack welds shall be deposited in accordance with the welding specification. Where preheat is applied then the temperature stipulated shall be operated prior to tack welding and maintained until the commencement of full joint deposition.

3.3.9.4 Completed Welds

Completed welds shall be free of pin holes, cold shuts or other defects and shall have a smooth uniform appearance. It is important that "icicles" are not formed in the bore, and welds showing such defects on radiographic examination will be regarded as faulty.

3.4 Construction

3.4.1 Cleanliness

Every precaution shall be taken to ensure that the inside of the pipe is kept clean and dry during laying and that the lining coat is not damaged. All internal welds shall be cleaned and debris removed. All spur lined shall be thoroughly cleaned before final attachment to header. The Contractor shall ensure trenches remain dry at all times.

A high standard of cleanliness shall be maintained during construction. All lines must be pulled through with a soft pull-through before positioning for welding. All lines shall be left capped or plugged at all times when work is not in progress in order to prevent the ingress of dirt and/or water. When installing, stressing of pipes and components shall be avoided. Lines shall not be sprung and forced into place, and if fabricated piping does not fit it must be cut and rewelded. Line pipe shall be laid away from valve chambers and other fixtures, and not laid towards such items for purposes of fit-up.

3.4.2 End Caps

Temporary (plastic or similar) end caps shall be securely attached to end of each length of pipe until that length is positioned for welding and being directly worked on. End caps shall be replaced as soon as the relevant part of direct work on the relevant open end has finished.

When end caps are removed the inside of the relevant pipe shall be cleaned by pulling a soft pull-through swab through it.

The entry of ground water into the pipe during installation shall be prevented. This may require more precautions than simply ensuring that pipe end caps are in place.

3.4.3 Pipe Handling

All pipe whether wrapped or bare shall be lifted with care using mechanical equipment. Pipe shall not be allowed to drop or strike hard objects and wrapped pipe shall not be dragged or skidded into position.

When lifting pipe slings, properly constructed webbing or fabric slings shall be used. Lifting hooks shall not be used direct on pipe in order to avoid damaging the internal lining. For the avoidance of doubt, hooks inserted into pipe ends shall not be allowed, and any pipe found to be so lifted shall be rejected at the risk and cost of the Contractor.

Lowering of pipe into the trench shall be done in such a manner that is does not injure the pipe or the protective coating. The pipe shall only be handled with soft strops on a spreader bar with the strop direction of pull being perpendicular to the pipe. The pipe shall be choked by the strop to prevent it slipping whilst lifting.

The Contractor shall submit details of it proposed pipe handling methods to the Employer for review and approval.

Pipes shall be laid and supported in the trenches at the correct slope and on a layer of sand of minimum 300 mm thickness. If sleepers are used for the alignment of the piping the coating of the pipe shall be protected by a pressure equalizing intermediary liner.

3.4.4 Holiday Test on Pipeline External Coating

A 100% holiday test shall be carried out with a test voltage of min. 15 kV and max. 20 kV (or voltage as advised by the coating repair manufacturer) whilst the pipeline is strung out along the edge of the trench, prior to lowering into the trench and repairs carried out as necessary.

Coating repairs shall be tested with "Holiday Detector" with a test voltage of min. 15 kV and max. 20 kV (or voltage as advised by the coating repair manufacturer).

3.4.5 Radiography Examination

Radiographic inspection of pipe welds shall be carried out on 100% of all welded pipe joints. The use of alternative methods of NDT such as magnetic particle or liquid penetrant methods may only be used where radiography cannot be carried out. The use of these methods shall have been reviewed without objection by the Employer.

The Contractor shall ensure that site inspection and radiographic examination procedures comply with the requirements of API Standard 1104 or BS.EN 1435 (1997). The procedures shall have been reviewed without objection by the Employer prior to use.

Radiograph exposure records of date, location, area, film number, serial number, film combination, time, source-film distance, angulation, weld number and other pertinent

information shall be prepared and kept and a summary with an expert interpretation by an independent laboratory shall be submitted for each weld.

3.4.6 Cleanliness After Welding

The Contractor shall immediately after welding thoroughly clean the inside of each length of pipe and each fitting with a soft swab to remove any dirt, sand and foreign matter that may be in the line after installation. The entire absence of foreign matter from the completed line will be a condition of acceptance of the Works or the System, as the case may be.

Water tight caps shall be available for use prior to storms and overnight. The Contractor's proposals must be submitted in advance for review by the Employer.

3.4.7 Inspection

All welds shall be thoroughly cleaned prior to inspection.

3.4.8 Weld Records

Each weld shall be individually numbered.

Pipe drawings identifying the location and number of the weld shall be continually updated and finally submitted as part of the as-constructed drawings.

3.4.9 Pneumatic Test

The Contractor shall, carry out pressure testing of as-constructed sections of pipework as soon as possible after completion of installation and welding of a relevant and conveniently-sized section. This is in order to ensure that there are no gross defects / integrity issues. This shall consist of pneumatic tests. Pneumatic tests shall be carried out upon each section of pipework following its installation in the trench but before backfilling.

Pneumatic testing may be omitted at the discretion and risk of the Contractor, provided the same has been intimated to the Employer as a part of the Technical Proposal of the Contractor and the same has been accepted by the Employer.

After positioning the line in the trench and completing welding, the section of line shall initially be pneumatically tested by applying a pressure of 1 bar g dry air holding for three hours and bubble testing all joints with soap solution. Joints shall show no sign of air leakage. For the avoidance of doubt, no other type of pneumatic test (i.e. at higher pressure) for the purposes of strength testing shall be permitted.

3.5 On-Site Pipeline Joint Protection and Wrapping

3.5.1 General

This section of this volume of Employer's Requirements provides for on-site anti-corrosion protection of pipeline field joints, bends, fittings and repairs to damaged factory coatings.

3.5.2 Material Specification

The protective wrap shall be by heat-shrink sleeve compatible with the external pipe coating as the preference. Cold-applied heavy-duty polyethylene wrap compatible with the external pipe coating will be accepted where Contractor can demonstrate that heat-shrink sleeves are not practicable.

Protective wrap shall be protected and separated in the roll by an over-width removable interleaf, which shall extend 12mm each side of the wrap. A flush (same width as wrap) interleaf, would allow pick-up of adjacent grit, dirt, etc., and such contaminants would provide a potential moisture path beneath the wrap. Additionally, the over-width property of the interleaf shall ensure its ready removal throughout the ambient temperature range of application, and equally, even after possible prolonged periods of storage.

3.5.3 Procedures for Joint Inspection

The existing protective coating at each side of each butt welded joint and the bare metal shall be cleaned free of all rust, weld spatter, mill scale, dirt, dust, lime wash and all other deleterious matter.

The clean, dry, prepared surfaces shall be brush primed with one thin continuous coat of the joint protection manufacturer's primer which shall be allowed to dry completely.

Where tape wrap in accordance with this Employer's Requirement is used, clean, dry, prepared surfaces shall be spirally wrapped with the appropriate width, employing a 55% overlap and using sufficient tension to ensure complete conformance and intimate adhesion of the wrap to the primed surfaces. The tape shall overlap the existing protective coating at each side of the joint by a minimum of 75mm. End laps between adjoining rolls shall be a minimum of 150mm.

On completion field joints will be inspected and tested by a qualified person using approved holiday (pin hole) test equipment and to the satisfaction of the Employer.

3.6 Removal of Temporary Works and Installation of Permanent Works

3.6.1 General

a. Any excavation within 600 mm of any existing line shall be carried out by hand in order to avoid mechanical damage to the line or its external coating.

3.6.2 Preliminaries

(1) The Contractor shall check the section within the existing valve for the presence of hazardous (hydrocarbon) liquid or vapour.

(2) Contractor shall check the status of the tie-in valve (VC-01) for its integrity. If the valve is found integral, the main header (DN250) shall be connected as shown in the general arrangement drawing. If the valve is not integral, appropriate measures shall be concluded with the approval of the Employer. As a minimum, a spectacle blind shall be installed downstream of the valve and subsequently connected.

(3) Where necessary, upon approval of the Employer, Contractor shall drill a 6 mm diameter (or similar size) hole in the top of the pipe (in a part which will ultimately be cold cut out and discarded) and "dip" the pipe to determine whether there is any residual fuel. After the dipping the Contractor shall drill another hole in the bottom of the pipe. During all this process, liquid tight drip trays or 200 litre oil drums cut in half (around the girth) shall be in place to capture any residual liquids. Such containers shall be adequately bonded to the parent pipe.

(4) Once drained, the Contractor can remove the blind flange and any remaining liquid shall be removed by swabbing out.

3.6.3 Gas Freeing

(1) Once the blind flange has been removed, the existing line should be vented and gas freed.

(2) The existing line shall be declared gas free once the vapour concentration therein is below the lower explosive limit for Jet A-1 and continues to remain so. Any incidence of vapour concentration exceeding the lower explosive limit for Jet A-1 shall require the Contractor to take further action to achieve a vapour concentration below the Lower Explosive Limit for Jet A-1. Contractor to note that flash point of Jet A-1, which is 38 degrees Celsius or greater, unless the residual fuel is above this temperature the fuel will not produce sufficient vapour to register on the gas detector. This does not mean that there is no residual fuel present. Therefore, it not assumed that the area is safe for hot work. The Contractor shall note that there is also likely to be considerable odour even though the gas detector does not register. Cold works shall be the only works permitted thereafter unless further preparations and isolations can be undertaken for any hot works required on the pipeline.

(3) The existing line shall be gas freed by natural venting augmented by forced purging with air introduced into the open end of the line. Tests shall be carried out using an approved explosimeter on a frequent basis at relevant locations in order to check the vapour concentration within the existing line.

(4) Forced purging shall be by an air compressor or a fan, axial or centrifugal (depending on the pressure drop requirements). The metal parts of the apparatus shall be electrically bonded to the pipe and shall be electrically earthed.

(5) The open end of the existing line shall be supervised at all times and not left open unattended. At such times the Contractor shall implement precautionary measures in order to avoid the risk of dirt/debris/water entering the existing line and in order to avoid the uncontrolled emission of hazardous vapours into areas where separate hot works may be taking place. This includes the time after cold cutting and end preparation has taken place as described herein. In addition, the Contractor shall consider and take necessary measures to deal with the nuisance problem of the odour noting that until the pipe is completely dry of hydrocarbons there is likely to be an odour.

(6) The Contractor shall pay particular attention to testing the Works for gas free status prior to and during cold or hot works and/or when piles are being driven. During such tests, it shall be necessary to remove any closure of the existing line.

3.6.4 Cold Cutting and End Preparation

(1) The Contractor must advise, in advance, what practical cold cutting methods will be used. Cold cutting includes such methods as hacksaw

and in situ machining of various types. It does not include grinding (which produces sparks).

(2) Suitable width and depth of excavation shall be made to enable cold cutting equipment to be used. Trench backfill material shall be cleared from around the cold cutting location and stabilised as necessary in order to avoid the risk of material from the trench entering the line during and after cold cutting.

(3) Cold cutting works or works involving the line end being open shall not be carried out when weather conditions or other works in the vicinity may give rise to risk of dirt/debris/water entering the line.

(4) Once cold cutting has been completed at each location immediate closure of the open end of the existing line shall be made by expanding plug until permanent closure is achieved.

(5) The area shall be safeguarded from flammable vapours by establishing a temporary local vapour plug and undertaking local gas detection.

(6) If any dirt/debris/water does enter the open end of the line it shall be removed by swabbing and/or by use of a soft pull-through. In any event, the line shall not be left open when unattended.

3.6.5 Welding

(1) In this project flanged tie-in is what envisaged and no welding tie-in is foreseen.

(2) It is envisaged that only weld-o-lets (DN250 x DN150) may need to be welded to the existing header. Contractor shall ensure that before any hot works are performed on the existing header it is completely gas freed.

(3) If necessary, Downstream sections of the new Hydrant System shall have been prefabricated and installed in the trench beforehand. Once such sections have been installed in the trench, it should remain for a pup piece between 2D (Pup piece shall be of minimum 2 x diameter of pipe) and the prepared end of the existing line to be welded in place in order to complete construction.

(4) If point 2 above is pursued, then this shall be carried out by inserting an inflatable bladder (nitrogen filled) into the open end of the Existing line. The inflatable bladder should be pushed well into the open end of the existing line (minimum 1.5 m to avoid risk of burning from welding) and inflated. Inflation lines and tethers should be drawn out through the pup piece and through the DN150 riser to grade level so that the inflatable bladder can be deflated and withdrawn though the WT and that there is no risk of losing control of the bladder during welding or subsequent operations.

3.6.6 Testing

NDE and other testing shall be in accordance with the other relevant section of this Employer's Requirements and shall include without limitation radiographic testing of butt

welds, pressure testing with Aviation Fuel and integrity testing of field-applied external line coating(s).

3.7 Filling with Aviation Fuel and Venting

3.7.1 Purpose

To introduce Aviation Fuel Jet A-1 into the new hydrant sections.

3.7.2 Implementation

Contractor to propose the option to fill the system. It can be either through VC-N1 or VC-02 or VC-03 or through Terminal 2 Via VC-01.

Bleeding air will be by valve, clear hose and drum. Bonding shall be implemented correctly. Failure to bond correctly at any time shall be classed as an unsafe act and shall incur relevant investigation procedures and disciplinary measures. Contractor shall ensure that all its personnel engaged in relevant activities are fully trained in the requirements for bonding.

4 Testing and Pre-commissioning

4.1 General

Pre-commissioning shall comprise all activities required to raise the as-constructed Works to a status where they can be safely and efficiently commissioned (including commissioning with Aviation Fuel). Without limitation, pre-commissioning shall include pressure testing, soak testing, dry test runs, leak testing, demonstration of correct functionality as isolated systems, demonstration of correct emergency shutdown protocols.

All risers/spurs shall be pressure tested, soak tested in situ contemporaneously with the testing of the main DN250 hydrant lines.

All pre-commissioning activities shall be part of the Contractor's standard Quality Assurance Plan as a Technical Proposal as a tender submission, and Contractor shall then develop Works -specific procedures and method statements, which shall be approved by the Employer.

Pressure testing using Jet A-1.

- Contractor shall safeguard fuel quality to the extent that fuel remains fit for purpose (i.e. hydrant fuelling of commercial aircraft) on completion of its use for pre-commissioning and commissioning the Works, and Contractor shall implement all relevant safety provisions (e.g. confined space entry procedures, mitigate explosion risk etc.).

Relevant section of these Employer's Requirements with respect to filling with aviation fuel and venting shall be used at this stage.

The supply of Aviation Fuel shall be the responsibility of Employer

Employer will arrange for provision of Aviation Fuel in bowsers. The Contractor shall advise Employer at least 6 (six) weeks prior to planned Commissioning activities the quantities, locations and times when Aviation Fuel is required and Employer will endeavour to oblige. Contractor will work diligently to minimise the amount of Aviation Fuel required each time but this shall not compromise achievement of safe and efficient Pre-Commissioning in any case. It is expected that once Aviation Fuel has been used for Pre-commissioning, Commissioning will follow seamlessly and therefore movement of Aviation Fuel out of and subsequently back into the new sections of Hydrant System can be minimised.

Employer shall provide a fire tender at the Airport for all pre-commissioning activities.

Contractor shall be responsible for the Aviation Fuel for testing and Commissioning whilst on the Project Site and shall maintain a quality control plan and stock documentation including the following:

a) batch sample labels

b) sample despatch advice

c) storage checks

d) stock records

e) filter membrane test ("**Millipore**") results

All specialist testing, examination and other activities shall be Contractor's obligation and whether onsite or offsite shall be performed by an independent subcontractor/organisation. This shall include but not be limited to:

- Laboratory tests
- Weld examination
- Independent calibration of contractor test equipment

4.2 Pressure Test

4.2.1 General

The contractor shall account the location of the cargo apron which is on the downstream of Terminal 2 header. Accordingly, the pressure test shall be planned in a manner that the operations of Terminal 2 is not hampered by any means.

Contractor shall propose the pressure test methodology in consultation with the operations team. i.e. as part of current scope, the pipe modifications are to be done on the 6 existing risers, existing header and subsequently new header is to be constructed. Accordingly, the hydrotest need to be done on the entire stretch of the cargo apron which extends from VC-04 to VC-N1. If any valve in the system is to be subjected to test pressure then the same shall be certified by the valve manufacturer to confirm that the valve would withstand the test pressure of 28.8 bar for 24 hours. Any creep / damage to the valve has to be replaced by the contractor at its own cost ensuring that it does not hamper the airport operations. In the event of removal of valve for the purpose of hydro test then a temporary spool may be used in place to ensure connectivity. It is foreseen that valves within VC-01, VC-02 & VC-03 may be removed and a temporary spool can be used whilst VC-N1 with a blind. In the event of valve removal is impossible, then the valve shall be kept in open condition and blinded downstream (in the cases of VC-02 & VC-03 weld cap would suffice to replace the blind) so that the valve stem/wedge does not see the full test pressure. Upon completion of hydrotest valves shall be reinstated in respective chambers and in VC-N1 new valve shall be installed.

The contractor shall submit a method statement for pressure testing to the Employer for review without objection by the Employer. This method statement shall include HSES statements as well as data logging and recording provisions. Test pressure 28.8 bar which is 1.5 times Design Pressure (maximum allowable operating pressure) of 19.2 bar.

All equipment likely to sustain damage during testing shall be removed from the pipeline. Control valves shall be left in the open position. Ball valves shall be left in the part opened position.

Where valves are not suitable for the proposed test pressure, they shall be removed and open ends of relevant lines shall be closed with suitable blind flanges. Subsequent replacement of valves and any other item(s) which have been removed to allow pressure testing to be carried out shall be subjected to online test followed by a leak test at 15 bar to ensure system integrity.

Special attention is drawn to the possible use of hydrant pit boxes (and low point drain and/or high point vent pit boxes) which have an integral stub of riser pipe supplied as part of the assembly. Occasionally problems arise in setting these assemblies at the correct level with respect to final apron level by the time of pressure testing because such level has yet to be completed, and therefore some or all hydrant risers cannot be cut to final length prior to pressure testing. Once hydrant risers are cut to final length and each hydrant pit box assembly is tied-in there may be reluctance to subject each tie-in butt weld to pressure

testing and consequently there may be temptation to classify the tie-in butt weld in each case as a non-pressure tested closure weld (as described in ASME B31.4, also known as "**Golden Weld**") and subject it to additional NDE. **This will not be accepted and the Contractor shall be responsible to ensure that** all such tie-in butt welds shall be fully pressure tested to the same pressure as the remainder of the system and Contractor shall plan the sequence of Works accordingly even if this means additional pressure testing is required.

The pressure test duration shall be a minimum of 24 (twenty-four) hours after temperature stabilisation has been established. The definition of temperature stabilisation is defined in AS/NZS 2885.5 (see reference below).

The Contractor shall be responsible for the supply of all equipment necessary for pressure testing and shall include the following:

The Contractor shall ensure all test equipment and instruments have certificates for accuracy, repeatability and sensitivity with all gauges checked immediately prior to each pressure test. The volume of fuel shall be measured by equipment having an accuracy better than ±1 % or as required by AS 2885.5, whichever is the greater.

All other miscellaneous equipment necessary to carry out the pressure test shall be provided by the Contractor.

All pressure and leak tests shall as a minimum be recorded/monitored on:

- Dead Weight gauge with readings logged every 15 minutes – use of a dead weight gauge is mandatory as an online pressure measurement device throughout the pressure testing activity (i.e. not just as a tester for other gauges)
- 10-inch dia. Standard Test Gauge
- Electronic online data logging in the form of pressure/temperature data points
- Pressure recorder (8-hour rotation duration)
- Temperature recorder (test medium, 8-hour rotation duration)
- Temperature recorder (ambient air, 8-hour rotation duration)
- at least on K series thermocouple, per test, the thermocouple to be wrapped to the buried pipe at a location agreed with the Employer (under the wrap, but not touching the pipe and at a point that will be representatively backfilled - the thermocouple will not be recovered at the successful completion of the test) and use a data logging read out device to record temperatures digitally to 0.1 degrees Celsius. The cable from the thermocouple needs to be sufficiently long for the recorder to be attached. Another thermocouple to be attached to the pipe in the valve chamber as an additional temperature indication. This should have a lead long enough for readings to be taken outside the chamber (or for it to be data logging, to avoid repeated confined space entry).
- pressure test pump that will not contaminate the test fluid
- method of accurately measuring fill volumes and pressurising ("squeeze") volumes

It is hereby clarified that chart recorders will not be accepted as means of pressure or temperature measurement for calculation or any other purpose, their use is merely to demonstrate that pressure testing is continuous over the test period.

All instruments shall have been calibrated within 48 hours prior to being connected to commence the test.

Head pressure (i.e. static head of liquid test medium) shall be taken into account but where possible the test gauges and recorders shall be at the lowest point.

Any drop-in test pressure not explainable due to temperature variation shall not be acceptable and re-testing is required following investigation, explanation of possible causes and rework as necessary.

Non-visibility of leakage shall not be an acceptance factor.

Contractor shall carry out full calculation of pressure testing (including temperature effects) and prove that the test section is tight. Whilst the established codes (API 1110, BS8010) do not contain sufficient information on such calculation, Employer will accept in full the calculation methods contained in AS/NZS 2885.5 and makes this a specific requirement of the Works.

4.2.2 Procedure

Following pneumatic testing and closure, the line shall be filled with test medium (Jet A-1 or potable water), the pressure raised to the test pressure of 28.5 bar g and monitored for 24 hours. Pressure shall remain constant for the 24-hour test period. Any unexplainable decay in pressure indicates a leak. Allowance shall be made for temperature effects on pressure, i.e. temperature shall be monitored and the effect of temperature changes on pressure calculated.

This test shall conform with AS 2885.5 in all respects (in particular the calculation of integrity – and the Contractor shall develop a clear and easy to understand methodology for integrity calculation and justification of integrity) and the test medium shall rest in the pipe for 48 hours prior to applying the test.

During the rest pressure period a modest pressure can optionally be applied (10 bar). A pressure relief valve must be fitted during the entire test period. The section under test shall be completely buried prior to the 24-hour test. Any exposed pipe shall be insulated and shaded. It may be necessary to run the test for longer than 24 hours to achieve a satisfactory 24-hour period that can be interpreted.

Records shall be kept of each test. The information shall be recorded and shall include:

(a) Pipeline of System Tested – including isometric drawings, line IDs, equipment Tag Nos.

(b) Testing Medium

(c) Test Pressure

(d) Pressure Test Volume Plot for Air Content

(e) Pressure Log and Chart Plot – for the avoidance of doubt, pressure shall be measured by Deadweight Gauge/Tester with use of data loggers as appropriate; chart recorders shall only be accepted to prove that the test was continuous and shall not be accepted for temperature or pressure measurement

(f) Test Medium, Ground, Ambient temperature Log and Chart Plot

(g) Date of test

(h) Duration

(i) Calculation and justification of test section integrity

(j) Signature of Contractor, signature of RPE

(k) Identity of all Test Personnel

(l) All Relevant Check Lists and Work Sheets

Hydrostatic testing of pipeline shall be carried out in sections between permanent flanges which will ultimately reside in valve chambers. The Contractor shall plan its work accordingly and shall avoid test sections which are not of this nature such that additional welding is required post-test in order to complete a section to a permanent flange in a valve chamber (and this will require a complete repeat of the hydrostatic test to the satisfaction of the Project Engineer). The Contractor shall blind flange sections for testing where required and, after testing, cut off and make good the blind flanged sections (or weld on test sections). Depending upon the staging of the Works the Contractor may not have access to the isolation valves for a section at the time that section is to be tested.

The Contractor shall be responsible for obtaining all Clearances e.g. from fire department, required to allow testing to be carried out and meet with fire department's certification requirements with regard to the test.

At the time of hydrostatic testing if Jet A-1 is used as the test medium the soak test shall also be carried out on completed pipework. Fuel shall be tested pre and post soak to identify any deterioration in fuel properties in accordance with JIG2.

The Contractor shall submit its Testing Plan p which shall define at what stages the Contractor intends to carry out each test, to the Employer for review and approval.

All NDE results and certification shall be reviewed without objection by the Employer prior to any pressure testing of pipework. The Contractor shall make a visual inspection of all joints and connections to ensure integrity of pipe section to be tested.

The Contractor shall provide all hoses and connections necessary to introduce fuel, to transfer fuel between and to remove fuel from the pipe sections to be tested.

All equipment used or supplied by the Contractor shall be submitted to the Employer for review and approval and shall be suitable for use with Jet A-1 fuel and shall be totally clean and free from all dirt, debris and other matter which is harmful to the quality of fuel.

The extent of recertification testing of pipework shall be subject to review and approval by the Employer.

Hydrostatic pressure test readings shall be recorded at least every 15 minutes with the minimum hydrostatic pressure test period being 24 hours at full test pressure. This test period shall be extended if pressure variations cannot be explained by temperature variations until stabilised results occur.

A successful test shall be commenced when pressure and temperature become constant and any variance between temperature and pressure can be calculated to accurately justify any variances within the test period. A period of temperature fall and the associated pressure response shall be compared with a period of temperature rise and the pressure response. The pressure and temperature values shall be input into the calculations required by AS 2885.5 to determine whether the test is a pass.

The Contractor shall carry out an air content measurement prior to testing by the following method. A plot of pressure against volume shall be constructed during the initial stage of pressurisation until a definite linear relationship is apparent. By extrapolating this linear curve back to the volume axis, the air volume may be assessed and compared with the total volume of test section.

A minimum period of 48 hours shall be allowed between filling of lines with fuel and hydrostatic pressure test commencement to allow for fuel stabilisation and temperature settlement. During this period regular venting of the pipe section shall be carried out.

The pressure in each section of line being tested shall not be permitted to rise more than 5% above the test pressure before release. The maximum pressure drop before re-pressurisation shall be 15%. The volume of fuel released or added shall be accurately recorded in the pressure test log. Once the system is depressurised or pressurised to the test pressure, the graph shall be stable for at least 4 (four) hours. If constant rise in pressure or drop in pressure is noted then it implies that thermal stability has not been attained and therefore the test has not been conducted within acceptable testing criteria and further work for rectification will be undertaken by the Contractor.

The Contractor shall not be permitted to re-pressurise a section of pipe within the last six hours of the hydrostatic pressure test on that particular section.

The Contractor shall appoint an experienced inspector to monitor pressure and temperature tests. The Contractor shall also ensure that over-pressurisation due to

The Contractor shall be responsible for protection of the hydrant pipework throughout the construction period and for ensuring that all trenches are marked and barricaded off for personnel protection. Hydrant risers shall be clearly indicated and surrounded by protective fencing.

Prior to Commissioning an additional hydrostatic test shall be carried out by the Contractor. This is a leak test and shall only take place after all hydrant valves and isolation valves have been fitted and the system filled and vented with Aviation Fuel. Test pressure for this test shall be 15.5 bar g and shall be of sufficient duration to inspect and prove all new flanged joints.

4.3 Soak Test

All carbon steel piping shall be subject to internal coating soak test (including soak testing of a representative number of test coupons prior to construction of the Permanent Works).

4.3.1 Purpose

- To ensure that Aviation Fuel Jet A-1 is not degraded by the internal epoxy coating of sections of line – this will be covered by a method statement developed by the Contractor and approved by the Employer.
- To test the resistance of the internal epoxy coating of sections of line to Aviation Fuel Jet A-1.

4.3.2 Application

Piping Systems - in order to investigate the effects of degreasers or corrosion inhibiting substances which may remain in these lines from manufacture, all buried piping systems shall be subjected to a soak test.

Aviation Fuel Jet A-1 will be provided by Employer and introduced into the section(s) of line to be tested by Employer with assistance by hydrant contractor.

It is easier to compare the results of soak testing if the original product was from one batch and was covered by one certificate of quality. However, it is possible that the product used

for soak testing may be made up from several original batches. Under these circumstances, control samples should be taken immediately before the soak period begins. The results of tests on samples taken at the end of the soak period should be compared with the results of tests on these control samples.

In cases when a single installation or refinery batch can be used to fill the tank or piping for the soak test, the results of tests on samples taken at the end of the soak period should be compared with the recertification results or the original Certificate of Quality results for the batch (whichever is applicable). Assessing for contamination will be easier if all product is supplied from the same refinery or installation batch.

4.3.3 Procedure

In compliance with JIG 2 (and also per JIG Bulletin 35 "Soak Testing") and on the basis that:

- the coating meets the performance requirements specified in EI 1541;
- the coating is properly applied and allowed to fully cure as per the manufacturer's recommendations; and
- the coating is covered by a 10-year application and material warranty.

product should be allowed to soak in the pipeline for a minimum of 4 days and a maximum of 7 days. If Contractor is unable to comply with the 10-year application and material warranty, the soak time will be increased to period approved by Employer.

After the soak period 2 x 5 litres composite samples (taken in approved sample containers) should be taken and one of these samples will be tested by Employer per the tests detailed in Figure 5.1 of this Volume of these Employer's Requirements. The other sample shall be retained in case further testing is required, and shall be retained until Employer accepts relevant soak test, after which sample(s) will be disposed of by Contractor in accordance with procedures for chemical waste handling and Applicable Laws.

However, fabrication of long sections prior to installation in trench (with subsequent risk on correct fit-up) shall not be acceptable if the reason for fabrication of long sections is merely to reduce the soak testing burden.

The Employer will not accept fabrication of long sections for soak testing which are then cut into smaller sections for installation because of the risk of coating burn back during cutting and/or subsequent welding. This includes stringing and welding of risers into one or more long assemblies for pressure testing in the yard.

4.3.4 Acceptance

Any difference between pre- and post-soak test results which is greater than the acceptable difference listed in the table below could indicate that solvent has been absorbed from the coating. Further investigation would be necessary and Employer's approval is required to proceed further, investigate or repeat test(s) which shall be done by Employer.

4.3 Figure - Acceptance Table

Soak Test (Jet A-1)

…Day Test Sample No: …… Project: …… Detail: ……..…

Steel Type: ……... Coating Material …… Coating Applicator:……

Type of Test (coupon, completed system etc.): ……..……

Sample drawn from (location): ……..…… By: ……..……

Fuel - Original Batch No: …….. From (source): ……...……

Fuel - Previous Certificate No: ……. Date of this report: ……..……

Date test began (sample drawn for analysis): ……

Date test ended (sample drawn for analysis): ……

Soak Test Duration (days): ……... Testing Laboratory: ……..

The following tests shall be carried out and the test report shall include the following table showing the Compliance Check fully completed. Contractor to consult JIG2 and amend this table in case of change to test requirements.

Property	**Test Method**		**Limits (see latest issue of AFQRJOS)**	**Present Recertification**	**Previous Certificate**	**Acceptable Differences (see latest issue of AFQRJOS)**	**Compliance Check (✓ or X)**
	ASTM	**IP**					
Appearance	D4176		C&B				
Existent Gum	D381	540	7.0 max				
Microseparometer (MSEP) rating **	D3948		70 min				
Electrical Conductivity pS/m at ºC	D2624	274	50 min to 600 max				
Saybolt Colour	D156						
Thermal Stability (JFTOT) *	D3241	323					
Control temperature, ºC 200 min			260				
Filter Pressure Differential, mm Hg max			25				
Tube Deposit Rating (Visual)			Less than 3, no 'Peacock' or 'Abnormal' colour deposits				
Distillation **	D86	123					
IBP ºC			Report				
10 % Recovered ºC			205 max				
20 % Recovered ºC			Report				
50 % Recovered ºC			Report				
90 % Recovered ºC			Report				
End Point ºC			300 max				

Property	Test Method		Limits (see latest issue of AFQRJOS)	Present Recertification	Previous Certificate	Acceptable Differences (see latest issue of AFQRJOS)	Compliance Check (✓ or X)
	ASTM	IP					
Residue, % Volume			1.5				
Loss, % Volume			1.5				
Flash Point ºC	D56	70	38 min				
Density at 15 ºC, kg/m³	D1298		775 to 840				

* It is recommended that the Thermal Stability of the fuel used for Soak Testing has a breakpoint of at least 275 deg C to allow for test precision

** Distillation by Simulated Distillation (i.e. IP406/ASTM D2887) is preferred because this test is more sensitive to residues/contamination

NOTES:

1. Should any discrepancy exist between the information contained in this Section and the current issue of AFQRJOS, any JIG Bulletin or JIG Standard pertaining to Soak Testing of the type contemplated hereto, the provisions of AFQRJOS and/or the relevant JIG Bulletin or JIG Standard shall apply.
2. Where minimum/maximum limits are given, the Acceptable Difference values do not apply to results below minimum or above maximum.
3. Precision data is not available for fuel containing Static Dissipater Additive. A MSEP rating below the minimum specification limit should be grounds for investigation, but is not to be used as the sole reason for rejection of a fuel batch

Recertification Approved by (name): ……. Signed: …… Date: ……..

Soak Test Approved by (name): ……..Signed: …… Date: ……..

4.4 Other Pre-commissioning Activities

Contractor shall demonstrate to Employer that all covers (hydrant pit covers, high/low point covers, valve chamber covers) are water-tight during a hydrostatic test which shall involve constructing a temporary bund/containment around each cover to be tested and allowing water to a depth of 100 mm to sit inside the containment for 10 minutes. Employer may at its sole discretion elect to waive this test on certain covers.

Contractor shall provide labour, temporary materials and consumables for the above pre-commissioning activities.

5 Commissioning

5.1 General

Commissioning shall comprise all activities required to raise the pre-commissioned Works to a status where they can be safely and efficiently operated. Without limitation, Commissioning shall include flushing main line hydrant sections and individual risers with Aviation Fuel, fuel-wetted test runs, demonstration of correct functionality as an integrated system, proof of correct emergency shutdown protocols under flow conditions.

All Commissioning activities shall be part of the Contractor's Quality Assurance Plan and provided in the Technical Proposal, and Contractor shall then develop Work -specific procedures and method statements, which shall be approved by the Employer. Contractor shall provide labour, temporary materials and consumables for the above commissioning activities.

In compliance with JIG Bulletin 39 "Hydrant System Commissioning" (Contractor shall ensure that up to date JIG requirements are implemented) and other relevant guidance material (including EI 1585) the following shall be carried out (please note that certain activities covered under JIG Bulletin 39 are included under Pre-commissioning in Section 4 above).

Contractor shall note that all relevant provisions of EI 1585 (Guidance in the Cleaning of Aviation Fuel Hydrant Systems at Airports) shall apply and that Contractor's method statements shall be drafted with this in mind and that Employer approval shall be premised on compliance with EI 1585.

5.2 Flushing with Aviation Fuel

Employer will arrange for:

- provision of Aviation Fuel in bowsers for filling hydrant sections or through VC-04 (Via Terminal 2) as the circumstance demands;
- provision of hydrant dispensers for dispensing Aviation Fuel into bowsers during flushing of hydrant sections;
- provision of bowsers for receiving Aviation Fuel during flushing of hydrant sections.

Employer will also arrange for all manpower to operate bowsers and hydrant dispensers, and any necessary Clearances to allow bowsers and hydrant dispensers to be used for the above activities. However, Contractor need to provide labours as requested by the Employer. None of the foregoing will relieve the Contractor of its obligations to deliver fully commissioned and operable Works pursuant to the Contract.

Contractor shall advise Employer at least 6 (six) weeks prior to planned Commissioning activities the quantities, locations and times when Aviation Fuel is required and Employer will endeavour to oblige. Contractor will work diligently to minimise the amount of Aviation Fuel required each time but this shall not compromise achievement of safe and efficient commissioning in any case. It is expected that once Aviation Fuel has been used for Pre-commissioning, Commissioning will follow seamlessly and therefore movement of Aviation Fuel out of and subsequently back into the new sections of hydrant system can be minimised.

All valves and pipework shall be subject to Commissioning activities. All valves shall be operated under full flow conditions. Venting shall be performed at all high points and all drains/low points shall be flushed until fuel samples are free from particulates and water (i.e. pass visual check per JIG). Low point flushing is not a one-off requirement but shall be performed during each Commissioning activity and shall be performed until all low points in each relevant section pass the Visual Check.

All specialist testing, examination and other activities shall be the obligation of the Contractor whether onsite or offsite shall be performed by an independent subcontractor/organisation. This shall include but not be limited to:

- Independent calibration of the Contractor's test Equipment.

Due to the configuration of the Works and the likely quantities of Aviation Fuel to be handled, flushing will be carried out via:

- Hydrant Main Lines: Flushing from one tank at the Fuel Farm, around the subject section of Hydrant System and back to bowser vehicles
- Hydrant Risers and Spurs/Laterals: Hydrant dispensers into bowsers.

The procedure which Contractor shall develop for Employer's review and approval shall contemplate hydrant main line flushing to acceptance first, to be followed by flushing of all individual risers/spurs/laterals to acceptance second, with repetition as necessary in order to achieve full acceptance.

Due to the requirement for several bowsers in order to safely receive fuel at the required flow rates and volumes, Contractor will initiate discussion with Employer at least 3 months prior to intended date of commencement of flushing in order to safeguard supply of bowsers. If it is clarified that if flushing into bowsers will not be possible either with respect to safety or resource availability, Contractor shall propose other methods, which may include without limitation the provision of temporary tankage (including necessary health, safety, environmental and security provisions which shall include without limitation overfill prevention/protection, containment, fire-protection). The Contractor shall indicate the cost of provision of these other methods in its Tender submission, as per the conditions of the Tender Documents and such cost will only be incurred under Employer instruction.

Prior to, during and after each flushing procedure at the required flow rate, low point drains shall be purged at regular intervals and samples shall be taken in a safe manner. Flushing of low point drains shall be carried out until samples are clear and bright and free from free and suspended water per JIG visual check.

Under the flow conditions achieved during flushing all flow instruments in line shall be monitored and compared. Any disparity shall be investigated and remedial action taken.

Under the pressure conditions achieved during flushing all pressure instruments in line shall be monitored and compared. Any disparity shall be investigated and remedial action taken by the Contractor.

Under the flow conditions achieved during flushing all temperature instruments in line shall be monitored and compared. Temperature variations may exist, however any major variations shall be investigated by the Contractor and rectified to the satisfaction of the Employer.

5.3 Commissioning Testing and Acceptance Criteria

The aim is to achieve a high flow velocity (where possible to exceed the maximum operational flow velocities achievable with the installed pumps – and Contractor shall work

diligently with Employer to ascertain this) to purge the system by creating turbulent flow velocities in the order of 2 m/s in all sections of the Hydrant system – this may require additional planning where lowest velocities would normally be expected (i.e. larger diameter sections). Contractor shall submit to Employer for review all calculations to support the flow rate that it requires for flushing of each section in turn as well as mitigation to prevent surge pressure e.g. using of surge suppressor. Once satisfactory, such calculations shall be approved by Employer and will become a Contractor obligation.

It is essential to flush for an adequate time to drive solid and water to low point drains and then drain and remove from the systems. On the basis that construction and subsequent activities have minimsed the amount of dirt/water in a given piping section, is generally accepted that it is necessary to flush approximately 2 – 3 times the volume of a system at the calculated turbulent flow velocity before acceptance criteria can be achieved. This is for guidance only and Contractor shall not rely on this statement. In all cases, Contractor is responsible for adequate flushing or the consequences of not fulfilling this requirement. Employer will carry out all relevant tests.

A piping or pipeline system can only be accepted as clean to the extent that it can proceed to operational readiness when:

- the results of line and drain line samples as selected by the Employer confirm that solid contaminant and free and suspended water are absent by visual check (as defined in Aviation Fuel Quality Control & Operating Procedures for Joint Airport Depots) to the satisfaction of the Employer; and
- where Filter Membrane test is carried out, "Consistent" colorimetric Filter Membrane test results are obtained between samples (i) entering the section of the pipework or pipeline system undergoing flushing and (ii) those leaving the section.

"Consistent" results indicate that the quality of the product leaving the flushed section is identical to that entering the flushed section i.e. no product degradation has taken place during the product's passage through the flushed section. A "Consistent" result is a difference of one colorimetric unit (e.g. B1 versus B2). Several colorimetric filter membrane tests should be performed before this conclusion is reached-one colorimetric filter membrane test at each point is not sufficient. Flushing shall continue until "Consistent" results are obtained.

Filter Membrane test membrane preparation, testing and final evaluation shall be in accordance with ASTM D2276/IP 216 Method for particulate contaminant in Aviation Turbine Fuel. A 5 (Five) litre samples shall be taken for all tests.

In certain cases, Employer may, at its sole discretion without reliving the Contractor of its obligations under the Contract, accept a piping system as clean to the extent that it can proceed to operational readiness on the basis of visual check sample results only, without need to carry out filter membrane tests.

For the avoidance of doubt, all other lines will be subject to filter membrane tests as detailed above unless specific relaxation is approved by the Employer.

All hydrant risers shall also be subject to gravimetric filter membrane test. Employer may in its sole discretion elect to waive obligation to carry out this test on all risers, and/or may permit the laboratory method of gravimetric test to be carried out in lieu of the online method contemplated hereto.

5.4 Operational Readiness

Once Commissioning has been completed in accordance with the Contract, the Contractor will propose to Employer that all hydrant sections which are part of the Works have been Commissioned to the extent that they are able to participate in safe and efficient commercial operation of the Airport Aviation Fuel Hydrant System (i.e. suitable for operational readiness). Employer shall then conduct the relevant test on the same in accordance with the testing Plans and the Contract.

6 Materials and Equipment

The following shall be read in conjunction with the Piping Class in Appendix 1

6.1 Piping Materials

6.1.1 Pulled Bends

Pulled bends shall be in accordance with ASME B31.4.

The bend centre line radius shall be 5 times nominal pipe diameter unless otherwise stated on Employer's drawings, and a test bend will be required.

6.1.2 Temporary Fittings

Temporary fittings, e.g. spades, blind flanges, valves, etc. shall be specified by the Contractor and shall have been reviewed without objection by the Employer prior to their use.

6.2 Internal Epoxy Coating of Pipe and Fittings

6.2.1 Scope

This section of these Employer's Requirements covers the internal coating/lining of pipe and fittings, in unit lengths, with coating/lining suitable for aviation fuel. The coating type shall be reviewed without objection by the Employer prior to its use. The coating/lining must have been tested and approved by a major supplier of aviation fuel as suitable for use with Jet A-1. Documentary evidence of this approval is required and a letter stating that the coating/lining has not been re-formulated since the approval. A major supplier of aviation fuel is considered to be one of the guarantor members of JIG (Joint Inspection Group) (currently the members are BP, Chevron, Eni, ExxonMobil, Kuwait Petroleum, Shell, Total).

Unless otherwise stated, internal epoxy coatings shall be applied to all pipe and fittings of DN 100 (one hundred) and greater. This includes the internal surface of weld neck flanges.

The requirements of JIG2 (Joint Inspection Group – Aviation Fuel Quality Control & Operating Standards for Airport Depots and Hydrants) shall apply in all respects – including without limitation coating material approval, application and testing.

6.2.2 Surface Preparation

The internal surface of the pipe or fitting shall be blast cleaned to BS 7079:2009 second quality, the maximum amplitude of the surface roughness shall be 0.1(zero decimal one) mm and minimum of 0.05 (zero decimal zero five) mm.

The type of abrasive and its particle size shall be to BS 7079:2009.

The blast cleaning procedure shall be to BS 7079:2009.

The photographic standard of surface preparation shall be to Svensk Standard SIS 055900-1967 Grade Sa.2.5. or ISO 8501-1 (2011)

The use of copper slag is prohibited.

Threads and flange faces are to be protected and are not to be blasted nor coated.

Defects revealed by blasting in the pipe shall be removed by grinding or small areas by file. If not accessible the pipe must be cut to remove the defect. The pipe must still remain in conformance with API 5L.

6.2.3 Coating Application

The coating used and its method of application shall be as per the test coupons supplied to the major supplier of aviation fuel described above for the approval and in addition be in accordance with the manufacturer's recommendations. The primary coat shall be applied within 2 hours of blast cleaning, unless dehumidification is used (< 50% RH). The manufacturer's instructions shall be observed on mixing, on time limits for application of the mixed coating and on time limits between coats.

Coating application shall be by airless spray or as otherwise agreed with the coating manufacturer and reviewed without objection by the Employer. Coating shall not be applied when the temperature of the prepared surface is below the dew point, or when the atmospheric temperature is below 10ºC, or when the relative humidity is above 85% or when airborne dust may be deposited on the coated surface.

The coating shall be applied in two or more coats to a total dry film thickness of 0.127 mm to 0.152 mm (or as an over-riding requirement, such other thickness as required by the coating material manufacturer), as measured by an Elcometer inspector or equivalent instrument reviewed without objection by the Employer. Over welds, a minimum dry film thickness of 0.1 mm is acceptable. Depending on the particular coating selected, other thicknesses can be proposed for review and approval of the Employer. The finished coating film shall be smooth and glossy and free from drips and runs. It shall be fully cured before the ends are sealed and before external coating is commenced. The finished coating film shall be tested for cure and adhesion as detailed below.

The entire internal surface of the pipe and fittings shall be lined except for an internal weld margin. This margin must be masked. A 35 mm mask is considered appropriate, though may be dependent on weld procedure as the concern is to prevent burn back of the lining/coating during welding. The welding bevels shall be tape-masked during application of the coating.

6.2.4 Testing Procedure

Before the lined pipe leaves the manufacturer's works, the coating shall be fully cured as indicated by the Ketone Test. The coating is rubbed for 1 minute with a clean white rag (coloured rag if the coating is white or off-white) soaked in methyl ethyl ketone (MEK). The surface rubbed by the Ketone rag shall show no (or only scant) sign of discoloration. The

surface should also be scratched by a finger nail and/or knife to determine if the MEK has caused any softening.

The adhesion of each coat shall be checked separately. This is to be tested by the cross-cut test as shown in BS 3900:1991: Part E6, or by cutting with a sharp knife a grid pattern of approximate square side dimension of 1 mm. A strip of Sellotape of similar sticky tape shall be pressed down on to the grid pattern and then ripped off. If squares of coating appear on the tape, adhesion is not adequate.

The Employer also reserves the right to apply a knifing test (see US MIL PRF 4556) whereby the coating/lining is scratched with a knife and the general toughness can be observed and lack of flaking and lack of homogeneity can be observed.

To allow testing of the first coat adhesion in a fully cured state, test pieces shall be provided. The test piece shall be a minimum of 100 mm by 50 mm and made of 1.626 mm (16 gauge) mild steel which has been shot blasted to Sa 2.5 at the same time as the inside of the pipe. The test piece shall be coated at the same time as the pipe. Lash the test piece to the end of the pipe.

The number of test pieces to be provided shall be

(a) At the beginning, middle and end of each shift and

(b) At the beginning and end of each coating mix used during each shift

Test pieces shall be given a traceable serial number such that they can be identified with given batches of pipe.

Subsequent to the adhesion and curing test specified above the test pieces shall be retained and sent to the Site for extended soak tests (see Appendix 3).

6.2.5 Inspection

The Contractor shall give twenty-eight days' notice to the Employer prior to pipe preparation and coating works being carried out.

Any coating which fails the tests for cure and/or adhesion shall be blasted off to bare metal and made good. Coating which is too thin may be built up, provided that the full inter-coat adhesion is achieved.

Each pipe shall be given a serial number (in chalk or suitable non-damaging marker on the outside) after satisfactory shot/grit blasting and inspection. The date and time of each of the various processes and inspection shall be recorded.

Each batch of coating shall be mixed to the manufacturer's instructions under the supervision of an inspector and the details of the mix recorded. It shall be possible to relate the coating batch mix number to specific lengths of pipe.

6.2.6 End Closures

The ends of each lined pipe shall be firmly closed and sealed with recessed plastic end caps, so as to prevent the ingress of foreign matter during shipping and handling of the pipe. Before closing, the levelled ends shall be freed from any trace of coating material and shall be protected from rusting by a layer of anti-corrosion tape.

6.3 External Coating and Wrapping of Pipe

6.3.1 General

This section of this volume of Employer's Requirements provides for surface preparation, priming, Polyethylene wrap coating.

The coating system shall consist of an epoxy primer, a second coat of adhesive layer 200 - 300 microns thick, and an external layer of factory extruded High Density Polyethylene (HDPE) of at least 220 micron minimum thickness. The system, including the epoxy primer shall be suitable for working under cathodic protection and written certification to such effect shall be supplied. The adhesive layer and extruded high density polyethylene shall be applied to DIN 30670 or other standard reviewed without objection by the Employer.

Electric holiday detection of 100% of the coating surface to 25 kV (or other voltage submitted and reviewed by the Employer) shall be performed and certified in writing. It must be ascertained that the voltage used is not a damaging voltage.

6.3.2 Surface Preparation and Priming

If pipe is supplied fitted with bevel protectors, they shall be removed and stored for re-use.

Temporary protective coatings, oil, grease and old paint, such as mill marking paint, shall be removed.

Surface preparation shall be by blast cleaning to "near white" as specified in BS 7079:2009, Second Quality.

6.3.3 Marking

Each section of pipe and fitting shall, after coating but before shipping, be marked externally with a unique number to identify it. This number shall also be marked on field fabrication and spool drawings to facilitate erection. Marking shall also identify the supplier and order number.

6.3.4 Certification

Material Certification for each pipe coated shall be supplied.

6.4 Hydrant Pit Assembly

6.4.1 General

This section of these Employer's Requirements covers the supply of hydrant pits for the below ground enclosure of hydrant pit valves, low point drain assemblies and high point vent assemblies.

The pits shall be suitable for installation in all types of pavement construction and shall protrude a 25 mm above the surrounding pavement level.

6.4.2 Hydrant Pit Body

The pits shall consist of a steel, cast iron, or fibreglass liner, or other material reviewed without objection by the Employer, with a main body having a minimum internal cross section dimension of 510mm and a minimum depth of 760mm. The body shall be provided

with four integral concrete anchors and a 40mm threaded drain coupling. The integral top flange shall require no extraneous corrosive material or welding fittings to support the cover assembly.

The bodies shall be of circular or square cross-section. If the body is to be of square cross-section all corners shall have a radius of not less than 50mm to facilitate cleaning. The body shall be of sufficient strength to support the ground loads imparted by aircraft or aircraft handling equipment (Live Load 420 kN/m²) without flexing of the walls.

The internal surface finish of the body shall be smooth and free from surface irregularities.

The body is to be designed to house a hydrant pit valve meeting the requirements of the latest edition of EI 1584 (Four-Inch Hydrant System Components and Arrangements).

The hydrant pit valve to be installed within the body shall be set such that the top of the hydrant pit valve is at a depth of 76 to 102 mm below the top of the lid. A minimum clearance of 40mm is required between the underside of the hydrant lid and the top of the hydrant pit valve, providing it does not conflict with the 76 to 102 mm depth requirement. Contractor to consult JIG bulletins to check for latest guidance on this issue.

In addition, the pit shall be suitable to enclose low point drain assemblies and high point vent assemblies.

6.4.3 Hydrant Pit Cover Assembly

The pit cover assembly shall consist of a completely removable two-piece ring and lid. The pit lid shall be fully opening with a maximum weight of 13.5 kg and have a minimum clear opening size of 460mm diameter. The ring and lid shall be type tested to a proof load of 60,000 kg located centrally on the lid and there shall be no permanent distortion of cover or lid when test load is removed. Replaceable waterproof seals shall be provided between the cover assembly and the pit body and the lid and support ring. The Contractor shall submit a test procedure as a part of the Testing Plan which shall include a method statement and proposed duration of test. The Testing Plan shall be reviewed without objection by the Employer prior to utilising the Testing Plan.

The cover shall incorporate the following features:

(a) can be lifted by one person wearing working gloves;

(b) the cover and rings shall be completely removable and shall prevent water ingress;

(c) the cover opening can be set at sufficient orientations to avoid difficulties in connecting the hydrant dispenser inlet hose in order to serve the aircraft types to be fuelled from that hydrant pit (e.g. the cover opening can be set at the 12, 3, 6, 9 o'clock positions);

(d) the cover opens to a lay-flat position, lying flat on the apron;

(e) if not hinged to the main assembly the cover has a stout tether to prevent it detaching or lifting clear when subject to jet blast or vortices.

6.4.4 Sealing

Pit box for Hydrant Pit Valve, Low Point Drain and High Point Vent - "Environmental" type in two-piece construction to provide a large ground movement (vertical ± 35 mm, horizontal ± 25 mm) with DN250 (10 Inch NPS) dia operational lid opening and positive seal + provision for DN600 (24 inch) opening for maintenance of pit components. Pit cover/lid to be positively

restrained from detachment (e.g. by bayonet closure, stout tether) against jet blast effects per JIG requirements and orientation of opening to be flat against apron surface.

The hydrant pit body shall be of the two-piece "Environmental" type meaning that it comprises two (2) concentric members which are free to slide vertically relative to one another such that:

- the outer member is anchored in the pavement and moves as aircraft weight deflects the pavement; and
- the inner member is fixed to the hydrant riser

so that aircraft loads are not transmitted to the Hydrant System. There shall be a renewable seal between the two concentric members. This seal shall be accessible for maintenance from grade level.

Alternatively, and less-preferably, the hydrant pits may be one-piece. The Contractor shall obtain prior approval of the Employer prior to implementation of this type of hydrant pit. In this case a flexible seal of fuel/water resistant material shall be provided between the pit and the riser pipe. This seal shall be replaceable in-situ without removal of the hydrant pit valve. All clamps and fixing plates shall be supplied by the pit manufacturer. The flexible seal shall be designed to allow a variation in installation length of 100mm minimum and 190mm maximum.

Top of pit box will be minimum 25 mm above apron level to prevent entrance of surface water. The slope away from the pit shall approximately be 4.0° or as per civil designer's recommendation and/or as per Applicable Laws.

Hydrant pit covers shall be flush to the apron to the extent that they stand 25mm above grade level to provide rain water run-off with a smooth and gradual bevel to grade level over a 1.5m square concrete pit surround and that profiling avoids damage from GSE vehicles on the apron area (especially main deck loaders).

6.5 Hydrant Pit Valve

6.5.1 General

This section defines the essential outline requirements of the isolating valve/API adapter and the required performance parameters but gives scope for individual manufacturers to produce satisfactory designs complying with the requirements of the Contract, these Employer's Requirements and Contractor Documents.

6.5.2 Equipment Arrangement

The arrangement of components is intended to ensure safety in operation consistent with equipment simplicity within the hydrant pit.

The components to be installed within the hydrant pit shall be of the same type as the existing hydrant pit valves at the Airport (or improved model) or direct equivalent and shall comprise the following: -

(a) a 4-inch API profile self-sealing tank-unit fuelling adaptor in accordance with EI 1584;

(b) a manually-operated, slow-opening/slow-closing isolating valve located upstream of the adaptor referenced to in (a) above, which will permit maintenance of the API adaptor or strainer under no-flow conditions without the need to depressurise the hydrant line or to drain-down the system;

(c) closure under flow conditions shall be by means of a "dual pilot" valve – meaning a detachable lanyard and a pneumatically-operated control from the hydrant dispenser vehicle; manual re-opening must be a simple operation;

(d) a 4-mesh stone guard of robust construction shall be located upstream of the isolating valve - the design shall be such as to require no maintenance or cleaning under normal operating conditions and shall be capable of withstanding a flow rate of 12,000 litres/minute;

(e) a separate or integral isolation valve which can be closed to isolate the hydrant pit valve for maintenance / removal.

(f) Insulating flanges to isolate the hydrant pit valve from the Cathodic Protection system.

6.5.3 Component Details

4-inch API Standard hydrant pit adapters shall be in accordance with the requirements of the latest edition of EI 1584 (Four-Inch Hydrant System Components and Arrangements). The adapter shall be provided without a grade-selectivity feature and shall ensure complete interchangeability and compatibility with all makes of coupler. The poppet shall be steel.

Isolating hydrant valves shall have a DN100 inlet flange in accordance with ANSI B16.5 and, when fitted with DN100 x DN150 spool adaptor shall be within an overall height range of 405 to 460 mm. The DN150 adaptor flange shall be class 300 raised face in accordance with ANSI B 16.5. The pressure loss requirement stated below shall include the spool adaptor. Valves with a Class 300 flange DN 150 and no adaptor spool may be submitted for approval by the Employer as an alternative.

Valves shall be "dual pilot", i.e. fitted with an air pilot in addition to the conventional manual lanyard shutdown control.

The hydrant valve shall close to reduce the flowrate evenly and progressively over a period of two to five seconds. At valve closure from 4500 litre/min overshoot shall not exceed 225 litres. Positive closure is required. Adjustment to the closure time shall be possible by means of either external controls or internal pre-set equipment. Closure shall be possible under both flow and no-flow conditions.

Valve opening shall be by manual means and opening to 90% of the rated flow (4050 litres/min.) shall be even and progressive within a period of 5 to 10 seconds (adjustable or non-adjustable).

The maintenance requirements of this valve shall be minimal and the design shall be such that the actuator mechanism and external seals can be serviced/replaced without removal of the isolating valve from the pit or depressurisation of the hydrant line.

The valve assembly shall have the facility for eventual extension to allow for settlement, i.e. adaptor spool. The overall height stated herein shall be maintained inclusive of the adaptor spool.

Pressure loss considerations are based on the recommendations of EI 1584 as applicable to this Employer's Requirements.

The pressure loss of the

> Isolating Valve + "Stoneguard" Strainer + Hydrant Pit Valve assembly + API Self-sealing Adaptor

shall not exceed 1.35 bar when flowing at 4500 litre/min when using Jet A-1 according to AFQRJOS (Latest Edition) as the test fluid.

6.6 Thermowells

6.6.1 General

This section of this details the requirements for thermowells which will be installed into individual section of the hydrant pipelines for the purposes of leak detection testing. The details shall be subject to the Leak Detection Supplier's approval

6.6.2 Detail

Thermowells shall be of the full penetration weld, tapped stem design.

The material shall be 316 stainless steel.

Thermowells mounting shall be DN50 ASME B16.5 Class 150 Flange.

The process connection shall be ½" – 14 NPT.

Inside diameter shall be minimum 6.6 mm. To be confirmed by LDS supplier

Immersion length from flange face: (2/3 of Pipe ID – Instrument supplier to confirm the depth of insertion in order to meet the accuracy limits)

- 326 mm – DN500 pipe
- 258 mm – DN400 pipe

6.6.3 Documentation

The following documentation shall be supplied with each item of Equipment:

- Contractor's Drawings
- Material certificate DIN 50049.3.1B
- Hydraulic test certificate

6.7 Pressure Transmitter

6.7.1 General

Part of Leak Detection System provision for pressure transmitter shall be made. Provision shall be provided as shown in the valve chamber detail drawing.

6.8 Valve Chamber Pipe Penetrations

Pipe penetrations in valve chamber walls shall be sealed with a link seal type sealing member backed up by a "Z" seal – all to be reviewed without objection by the Employer.

Chamber penetration for future expansion shall be made available now and positively blanked so that water ingress is prevented.

6.9 Valve Actuation

6.9.1 General

No motor actuators or envisaged to be used. Only manual actuation with the help of hand wheel and gear operation. However, adequate provision shall be in place for introducing motor actuator in the future.

6.9.2 Gearing

The actuator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. All main drive gearing must be of metal construction. The design shall be such as to permit the gearcase to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

6.9.3 Hand Operation

A hand wheel shall be provided for open and closure of valve

The hand wheel drive shall be mechanically independent and gearing shall be such as to permit emergency manual operation in a reasonable time with a maximum force of 250N on the rim of the handwheel being sufficient for valve operation. Clockwise operation of the hand wheel shall give closing movement of the valve.

6.10 Leak Detection / Tightness Monitoring System

Provision for Leak detection system shall be made which includes the stub for pressure transmitter, stub with thermowell for temperature transmitter. Provision shall be compatible to deliver a proprietary type of LDS fully in accordance with the requirements of the Energy Institute with respect to ability to resolve a leak down to 0.04 litre/m^3/hour shall be provided by the Contractor to monitor the integrity of the Hydrant System.

6.11 SCADA System

No SCADA interface is part of the current scope

6.11.1 ESD Inputs

Input from ESB push buttons and any associated power and signal related to ESD system shall be terminated at the ESD Marshalling box in the proximity as instructed by the Employer.

6.12 Valve Chamber Covers

Covers shall be all primary metal cast aluminium, No. A3 56.2, per US Fed Spec. QQ-A-60F with a T-6 heat treat per Mil. Spec. H-6088F, with no exceptions. The cover shall be torsion actuated one piece and open to 90° with a maximum 15 kg lift and close - with a minimum 22 kg push using torsion actuated mechanism.

Service lettering shall be abrasion/corrosion/chemical resistant, colour coded polyester powder coated.

Covers shall have integral, automatic latch with no above-grade protrusions whether in use or not. Rectangular cover latches shall be interconnected so that activating one unlatches both. Covers shall not pop open when a latch is released.

Covers shall be designed to fail-safe open once lifted beyond the 80° point in the opening arc, and once in the 90° position, remain fully open by gravity.

A hold-open bar shall be provided to automatically lock the cover in the full-open position, and to release with one-hand operation.

Covers shall have high visibility orange panels on the topside and underside for safety.

The cover shall be capable of withstanding aircraft loads.

The covers environmental test reports shall be submitted for review and approval of the Employer. The test shall be conducted by an independent testing company in the following categories and standards: -

(a) The totally submerged cover shall pass less than 100 grams of water per hour following: a) hot (71°C) and cold (40°C) cycling conforming to Mil Std-810 and b) seal contamination (cover seal area and mating flange/frame wall sealing surface packed with sand and soil).

(b) Covers shall pass submersion, corrosion and hose down tests equal to NEMA 250 standards for Type 6 exterior enclosures.

6.13 Cabling Distribution (Power and Control Cables)

6.13.1 General

1. Provision for installing Electrical and Communication cable shall be made available.

6.14 Cathodic Protection System

6.14.1 Design

6.14.1.1 Basic Requirements

The system will provide cathodic corrosion protection of the entire fuel Hydrant System. The cathodic protection system in accordance with API 1632, and the Applicable Laws.

The cathodic system includes AC power panel, cables, connectors, splices and other equipment to complete the system.

The requirements outlined here are minimum. The Contractor may propose alternates with appropriate justification yet the integrity of the system shall be maintained always and the Hydrant System is protected at all times. Safety of Hydrant system shall not be jeopardized in any event.

The cathodic protection system includes a) rectifier, anodes, and any recommendation for supplementing or charging the minimum design criteria to provide the specified potentials and b) equipment, wiring device necessary to produce a continuous flow of direct current from anodes in the soil electrolyte to the pipe surfaces.

6.14.1.2 Anode Design

Anodes shall be high silicon cast-iron anodes installed in low-resistance carbonaceous backfill.

Silicon cast-iron anodes shall have the following composition (% by weight):

Silicon:	14.20-14.75
Carbon:	0.70 - 1.15
Chromium:	3.25 - 5.00
Manganese:	1.50 max.
Molybdenum:	0.20 max.
Copper:	0.50 max
Iron:	Balance

The anode-to-soil resistance shall be less than 2 ohms.

The locations of the anodes shall be selected to minimize interference with building- and other underground facilities, for which reason remote ground beds shall be considered unfeasible.

Multi-anode beds shall not be placed under paved areas. Single anodes or deep well anode shall not be placed under paved areas unless future access that shall not require subsequent repair of the pavement is provided, for example by removable covers, tiles or equal.

The anodes and complete system shall be designed, supplied and installed by the Cathodic Protection System contractor to provide efficient protection for min. 25 years, allowing for 20% deterioration of the coating efficiency during this period without exceeding the manufacturer's recommended maximum anode current density.

6.14.1.3 Transformer-Rectifier

The transformer–rectifier system shall comprise a transformer, rectifying elements, transformer tap adjuster, terminal blocks, DC output voltmeter, DC output ammeter and over current protection for each DC circuit, variable resistors, an AC power supply circuit breaker, lightning arrestor for both input and output all wired and assembled in a cabinet. The enclosure shall have IP43 rating for outdoor mounting and min IP 2X for indoor mounting. Rectifying elements shall be silicon diodes connected to provide full-wave rectification. Silicon diodes shall be protected by selenium surge cells or varistors against over-voltage surges and by current-limiting devices against over-current surges. Meters shall be accurate to within plus or minus 2 % of full scale. Separate meters shall be 60 mm nominal size or larger. The transformer-rectifier shall as a minimum, provide automatic output current and automatic output voltage control. The transformer-rectifier shall be capable to supply voltage and current outputs of 30% above expected, i.e. calculated

Ultimate needs for the first phases of construction of the fuel hydrant system. The transformer-rectifier will be equipped for transmitting fault signals and output current signals to the SCADA system.

6.14.1.4 Cables and Connections

The factory-mounted anode cables shall be min. 10 mm2 (8 AWG) stranded copper cable insulated to min. 600 V. The inner insulation of anode head- or deep well anode cables shall be chlorine- and hydrogen resistant, as Halar, or fluorocopolymer.

Cables for connecting the anodes / anode beds with the transformer-rectifier shall be min. 25 mm2 (4 AWG) stranded copper wire with 600 V heavy-duty insulation.

All anode cables shall have an outer jacket of high molecular weight polyethylene, min. thickness 1.6 mm. PVC insulation or PVC- jackets shall not be used.

Cathode cables - between the transformer-rectifier and the pipes - shall be min. 25 mm2 (4 AWG) stranded copper cable with suitable insulation type.

Test wires shall be min. 2.5 mm2 (12 AWG) insulated stranded copper cables. The insulation type may be selected by the Contractor, but shall be for direct burial.

6.14.1.5 Test Stations

Test stations for insulation measurement shall be provided for each insulated joints of the pipeline system. This test station can also be used for the soil – to structure potential otherwise separate test stations is provided. For insulating joints testing one test lead from each side of the joints is brought to the test station. For potential testing one test lead is brought from the pipe and one test lead is brought from the reference electrode point to the test station.

6.14.2 Construction

6.14.2.1 Cables and Connections

Anode connecting cables will be installed in the factory by a central connection that ensures that the connection will not fail before the anode material has been consumed. The connection will be sealed in cast epoxy resin.

Cathode and test cable connection points for the structure (pipes) will be fixed to the pipes by exothermic welding and will be insulated with epoxy encapsulation or coal-tar insulated with subsequent felt- or Denso-tape wrapping.

6.14.2.2 Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements will be made using a copper-copper sulphate reference electrode and a potentiometer-voltmeter, or a direct current voltmeter having an internal resistance (sensitivity) of not less than 10 M ohm per volt and a full scale of 10 V.

Either of the following methods will be used for potential testing:

a): A negative voltage of at least minus 850 mV as measured between the pipe and a saturated copper-copper sulphate reference electrode contacting the earth directly over the pipe. Determination of this voltage will be made with the cathodic protection system in operation. Voltage drops shall be considered for valid interpretation of this voltage measurement.

A minimum of minus 850 mV "Instant Off" potential between the pipe being tested and the reference cell will be achieved over 95 percent of the area of the structure.

An adequate number of measurements will be obtained over the entire pipe to verify and record achievement of minus 850 mV "instant off". This potential will be obtained over 95 percent of the total metallic area without the "Instant Off" potential exceeding 1200 V.

b): A minimum polarization voltage shift of 100 mV as measured between the pipe and a saturated copper-copper sulphate reference electrode contacting the earth directly over the

pipe. This polarization voltage shift will be determined by interrupting the protective current and measuring the polarization decay.

When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, will be used as the base reading from which to measure polarization decay. Measurements achieving 100 mV will be made over 95 percent of the metallic surface.

c): A site investigation shall be undertaken, to determine whether sulphate reducing bacteria are present in the soil, and if so the pipe to soil potential of –950 mV (instant OFF) or more shall be maintained. The pipe to soil potential shall not be more negative than –1150 mV (instant OFF) versus copper-copper-sulphate reference cell.

6.14.2.3 Temporary Cathodic Protection.

Contractor shall design, supply and install temporary cathodic protection where those pipelines cannot be satisfactorily connected to the permanent system, or the permanent system is not ready and the pipeline would be left unprotected for a period of more than two months. The design life of the temporary cathodic protection shall be 5 years. It is expected that the temporary system will be a magnesium anode sacrificial system, with above ground temporary test points. However, the Contractor to determine the type of anodes.

7 APPENDICES

Appendix 1 Piping Class

Appendix 2 Valve Data Sheets

Appendix 3 Paint Mix Record

7.1 Appendix 1 Piping Class

Piping Class								
Service	**Basic Material**	Carbon Steel : API 5L Grade - B						
Aviation Fuel Hydrant System	**Flange Rating**	150 #						
	Flange Facing	Raised Face						
	Corrosion Allowance	0 mm						
	Temperature Pressure Limits							
	Temperature ^{O}C	0	+50					
	Pressure kPa (g)	1970	1930					

Piping Schedule																	
NPS (in)	½	3/4	1	1 1/2	2	3	4	6	8	10	12	14	16	18	20	24
DN (mm)	15	20	25	40	50	80	100	150	200	250	300	350	400	450	500	600
OD (mm)	21.34	26.67	33.4	48.3	60.3	88.9	114.3	168.3	219.1	273	323.9	355.6	406.4	457.2	508	609.6
WT (mm)	3.73	3.91	4.54	5.08	5.5	5.5	6.02	7.11	8.18	9.27	9.52	9.52	9.52	9.52	9.52	9.52
SCH	80	80	80	80	40	40	40	40	40	40	STD	30	30	20	20	20

Branch Connections – 90 Degrees ONLY

		Branch Size															
		15	20	25	40	50	80	100	150	200	250	300	350	400	450	**500**	**600**
Run Size	600	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	A
	500	C	C	C	C	E	E	E	E	E	E	E	E	E	E	A	
	450	C	C	C	C	E	E	E	E	E	E	E	E	E	A		
	400	C	C	C	C	D	D	D	D	D	D	D	D	A			
	350	C	C	C	C	D	D	D	D	D	D	D	A				
	300	C	C	C	C	D	D	D	D	D	D	A					
	250	C	C	C	C	D	D	D	D	D	A						
	200	C	C	C	C	D	D	D	D	A							
	150	C	C	C	C	D	D	D	A								
	100	C	C	C	C	D	D	A									
	80	C	C	C	C	D	A										
	50	C	C	C	C	A											
	40	C	C	C	A												
	25	B	B	A													
	20	B	A														
	15	A															

CODE	**EXPLANATION**
A	EQUAL TEE
B	REDUCING TEE
C	BRANCH FITTING - PLAIN END OUTLET
D	PIPE TO PIPE
E	BRANCH END OUTLET REDUCING BUTT WELD

Sr No	Description	Size Range (NPS inch)		Rating / Schedule	Material	Dimension Standard	End Connection	Notes
		From	To					
1	**Pipes**	1	2	Refer Table "Piping Schedule"	API 5 L Grade B Seamless	ASME B 36.10M	PE	Refer Note 1
		3	8		API 5 L Grade B Seamless	ASME B 36.10M	BE	
		10	24		API 5 L Grade B Seamless / DSAW / ERW	ASME B 36.10M	BE	
2	**Dip Pipe**	1 1/2	1 1/2	Sch 40S	ASTM A 312 TP 316	ASME B 36.19	PE	Refer Note 2
3	**Pipe Fittings**							
	Bends 90DEG	1	2	3000 #	Forged CS to ASTM A 105	ASME B 16.11	SW	
		3	6	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB	ASME B 16.9 (R = 1.5 D)	BW	
		8	18	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB	ASME B 16.49 (R = 3 D)	BW	
	Bends 45DEG	1	2	3000 #	Forged CS to ASTM A 105	ASME B 16.11	SW	
		3	24	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB	ASME B 16.9 (R = 1.5 D)	BW	
	Tees	1	2	3000 #	Forged CS to ASTM A 105	ASME B 16.11	SW	
	Reducers (CONC or ECC)	4	24	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB	ASME B 16.9	BW	
		4	10	as per pipe schedule	Forged CS to ASTM A 105	Wrought Carbon Steel to ASTM A 234 WPB		
	Couplings (Full & Half)	1	2	3000 #	Forged CS to ASTM A 105	ASME B 16.11	Welded	
	Weldolet	4	10	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB	-	BW	Refer Note 3
	Caps	1	2	3000 #	Forged CS to ASTM A 105	ASME B 16.11	Threaded	
		3	24	as per pipe schedule	Wrought Carbon Steel to ASTM A 234 WPB DXS	ASME B 16.9	BW	
4	**Flanges**							
	Weldneck	1	24	150# as per pipe schedule	Forged Carbon Steel to ASTM A 105N(Normalised)	ASME B 16.5,150#	WN, RF	Refer Note 4
	(Hyd, low pt, vent pt risers)		6	300 #	Forged Carbon Steel to ASTM A 105N(Normalised)	ASME B 16.5	RF	Refer Note 4
	Blind	1	24	150 #	Forged Carbon Steel to ASTM A 105N(Normalised)	ASME B 16.5	RF	Refer Note 4

Sr No	Description	Size Range (NPS inch)		Rating / Schedule	Material	Dimension Standard	End Connection	Notes
		1	24	300 #	Forged Carbon Steel to ASTM A 105N(Normalised)	ASME B 16.5	RF	Refer Note 4
	(Hyd, low pt, vent pt risers)		6	300 #	Forged Carbon Steel to ASTM A 105N(Normalised)	ASME B 16.5	RF	Refer Note 4
5	**Valves**							
	Plug Valve (block valve)	14	24	150 #	Body Cast Carbon Steel A216 WCB, Plug Cast Carbon Steel A216 WCB chrome plated Double block and Bleed fire safe non lubricated, retracting, resilient seal ,perpendicular wedge design ,metal to metal back-up, standard (reduced) bore .	ASME B16.34	Flanged RF to B 16.5	Refer Note 4A
	Gate Valve (block valve)	14	24	150 #	Carbon Steel Gate valve ASTM 216 Gr. WCB6, Rising spindle outside screw and yoke type as per API 600, ASME B 16.5, 150 class RF flange. Valve shall be gear operated and suitable for installation of electric actuator.	ASME B16.34	Flanged RF to B 16.5	Refer Note 4B
	Hydrant pit valve	4x4	----	150 #	Body Ductile cast iron, internally treated with copon EA-2217, Externally treated with acrylic paint finish with aluminium internals API Adaptor: Ductile cast iron with fluoropolymer coating/Stainless steel, steel poppet	API 1584 3rd Edition	Flanged RF to B 16.5	Refer Note 5
	Isolation valve (Hydrant)	6x4	----	Outlet 150 # Inlet 300 #	Body Ductile cast iron, internally treated with copon EA-2217, Externally treated with acrylic paint finish with aluminium internals	API 1584	Flanged RF to B 16.5	Refer Note 6
	Ball Valve (vent & drain)	$1^1/_2$	----	150 #	Body/Bonnet/cover Stainless Steel A351-CF8M, trim stainless steel ASTM A276-Grade 316, floating ball,single piece body reduced bore, antistatic	BS 5351	Flanged RF to B 16.5	Refer Note 7
6	**Gaskets**							
a	Gasket (Normal)	1	24	$^1/_8$" thk	Gore-Tex PTFE – sheet gasket/joint sealant complying with ASTM F37-B. Thickness 1.5mm for 15mm to 600mm piping above ground and 3mm for all underground pipework. Alternative: compressed fibre (NO ASBESTOS CONTENT PERMITTED) gaskets to ASME B16.5	API 601	Flange RF to B 16.5	
b	Insulating Gasket	1	24	$^1/_8$" thk	Full Face Phenolic	ASTM D229	Flange RF to B 16.5	Refer Note 10

Sr No	Description	Size Range (NPS inch)		Rating / Schedule	Material	Dimension Standard	End Connection	Notes
c	Insulating sleeve	All sizes		1/32" thk	Spiral wound Mylar		Flange RF to B 16.5	
7	**Washer(Insulating)**	All sizes		1/8" thk	Mylar		ANSI B 18.2	
8	**Hydrant Pit Box**	18"	24"	300#	Body Carbon Steel (Inner & Outer), 6 NPS API 5L riser pipe, Aviation fuel resistant Nitrile seal with heavy duty (Modern air craft load) light weight aluminum lid with detachable outer ring		Flanged RF to B 16.5	
9	**Bolting**							
a	Stud bolt	All Sizes			Carbon steel as per ASTM A 193 Gr B7, black	ASME B 18.2		Refer Note 8
b	Nut	All Sizes			Heavy Hexagon as per ASTM A194 Gr 2H	ASME B 18.2		Refer Note 8

Referenced Notes

1 Shop or mill applied external coating of Polyethylene (3 mm thk reinforced PE coating conforming to DIN 30670) and Internal Epoxy resin lining (AFHI approved type) as per MIL-C-4556E suitable for Jet A-1 as well as water (all in compliance with JIG 2).

2 Dip pipe in the drain arrangement only and positioned by insulator (ETRONAX) dia 140x10mm & SS washer.

3 Insert type weldolet only to be used.

4 Carbon content 0.23% maximum.

4A Plug valve to be manual actuated as determined by design requirements. Thermal relief to be confirmed in each case by design.

4B For bleed function, bonnet shall be tapped and fitted with plugged bleed valve. Thermal relief to be confirmed in each case by design.

5 Dual Pilot Valve - to be operatable BOTH manually by lanyard (to close) AND pneumatically by air pressure from control line deployed from hydrant dispenser. The valve shall be provided with 4" API adaptor.

6 6 " flange of the valve shall be rated 300# as per ASME B 16.5

7 Twin ball valve connected on a 6" flange with pressure relief valve. Valve unit shall have tank unit and pressure cap at the top. Refer CCMY4VN pressure cap (drawing no : ANMY4715). Riser vent SHALL NOT be sealed by tapped/screwed plug but SHALL be by permanent DN40 (NPS 1½) firesafe ball valve.

8 Not used.

9 Temperature range for piping materials = 0 deg C to 50 deg C

10 Min. 5000V dielectric strength in dry air

11 ERW is acceptable only in size range 10 – 24-inch NS and only if it can be demonstrated that source pipe mill is currently on the approvals list of a major oil company (BP, Chevron, ExxonMobil, Shell, Total) for manufacture of ERW line pipe in this grade and size.

General Notes

11 Not used

12 All forgings shall be normalised & tempered.

13 Carbon content shall be limited to 0.23% max for pipe & 0.25% max for other items (carbon equivalent shall be limited to 0.45% max).

14 Where flanges mate with ductile iron equipment the mating flange face shall be a smooth finish ra 6.3 µm to 12.5 µm.

15 All unconnected branches 40 NS and below shall be class 6000/schedule 160.

16 For selection of branch connections standard industry practice shall apply.

17 Buried lines shall be coated & wrapped.

18 Where screwed fittings are specified on the Drawings, threads shall be NPT.

19 Puddle flanges shall be carbon steel BS 4360 Grade 43A.

20 All pipework 100 NS and above shall be lined in accordance with Section 3 of this volume of Employer's Requirements.

21 Material test certificates to DIN 50049.3.1B shall be provided.

7.2 Appendix 2 Valve Data Sheets

7.2.1 Ball Valve – Stainless Steel

SPECIFICATION: BS 5351	**CLASS: 150 RF**	**SIZE RANGE: DN15 - DN50**
VALVE DESCRIPTION	**BALL VALVE, FLOATING BALL, SINGLE PIECE BODY, REDUCED BORE**	
	ANTISTATIC	
GENERAL:		
- FACE TO FACE DIM	BS 2080 : 1989 STANDARD PATTERN	
- BONNET/COVER FIXING	BOLTED	
- OPERATION	MANUAL LEVER	
- ELECTRIC MOTOR	N/A	
- FLANGE FINISH	RA 6.3 µm – 12.5 µm	
- SEALS	VITON	
- HANDLE	MAXIMUM LEVER LENGTH 195 mm	
MATERIAL:		
- BODY/BONNET/COVER	STAINLESS STEEL ASTM A351-CF8M	
- TRIM	STAINLESS STEEL ASTM A276 – Gr316	
- GLAND PACKING	PTFE/FLEXIBLE GRAPHITE	
- BOLTING	STAINLESS STEEL ASTM A276 – Gr316	
- SERVICE	AVIATION TYPE KEROSENE	
TEST:		
	HYDROSTATIC TO BS 6755:PART 1:1991	
	FIRESAFE TO BS 6755:PART 2:1987	
CERTIFICATION:	PRESSURE CONTAINING PARTS TO DIN 50049.3.1B,	
	NON-PRESSURE CONTAINING PARTS TO DIN 50049 TPYE 2.2.	
	FIRE TEST TO BS 6755:PART 2:1987.	
MATERIAL REQUIREMENTS:	CARBON CONTENT IS LIMITED TO 0.25%MAX (LADLE ANALYSIS) WITH CARBON EQUIVALENT LIMITED TO 0.45% MAX. USING FORMULA CE = $C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$	

NOTES:

1. PROCEDURE AND RESULTS OF HYDROTESTING SHALL BE IN ACCORDANCE WITH BS EN 12266:PART 1: 2012
2. NDE OF CASTINGS SHALL BE TO MSS.SP.55 WITH 10% SELECTED AT RANDOM TO ANSI B16.34 SECTION 8.
3. ALL VALVE BODIES SHALL HAVE A MINIMUM OF 1.5mm CORROSION ALLOWANCE.

7.2.2 Ball Valve – Cast Steel

SPECIFICATION: BS 5351	**CLASS: 150 RF**	**SIZE RANGE: DN15 - DN50**
VALVE DESCRIPTION:	**BALL VALVE,FLOATING BALL, SINGLE PIECE BODY REDUCED BORE**	
	ANTISTATIC	
GENERAL:		
- FACE TO FACE DIM	BS 2080 : 1989 STANDARD PATTERN	
- BONNET/COVER FIXING	BOLTED	
- OPERATION	MANUAL LEVER	
- ELECTRIC MOTOR	N/A	
- FLANGE FINISH	RA 6.3 µm – 12.5 µm	
- SEALS	RENEWABLE PTFE	
- HANDLE	MAXIMUM LEVER LENGTH 195 mm	
MATERIAL:		
- BODY/BONNET/COVER	CAST CARBON STEEL ASTM A 216-WCB	
- TRIM	STAINLESS STEEL ASTM A276 – Gr316	
- GLAND PACKING	PTFE/FLEXIBLE GRAPHITE	
- BOLTING	ASTM A193 – B7A 194 – Gr2H NUTS BLACK	
- SEALS	VITON	
DESIGN CONDITIONS:		
- PRESSURE	ANSI B16.5 RATING	
- TEMPERATURE	10ºC TO 80ºC	
- SERVICE	AVIATION TYPE KEROSENE	
TEST:		
	HYDROSTATIC TO BS 6755:PART 1:1991	
	FIRESAFE TO BS 6755:PART 2:1987	
CERTIFICATION:	PRESSURE CONTAINING PARTS TO DIN 50049.3.1B,	
	NON PRESSURE CONTAINING PARTS TO DIN 50049 TPYE 2.2. FIRE TEST TO BS 6755:PART 2:1987	
MATERIAL REQUIREMENTS:	CARBON CONTENT IS LIMITED TO 0.25%MAX (LADLE ANALYSIS) WITH CARBON EQUIVALENT LIMITED TO 0.45% MAX. USING FORMULA CE = $C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$	

NOTES:

1. PROCEDURE AND RESULTS OF HYDROTESTING SHALL BE IN ACCORDANCE WITH API6 D.
2. NDE OF CASTINGS SHALL BE TO MSS.SP.55 WITH 10% SELECTED AT RANDOM TO ANSI B16.34 SECTION 8.
3. ALL VALVE BODIES SHALL HAVE A MINIMUM OF 1.5mm CORROSION ALLOWANCE
4. PAINTING: MANUFACTURER'S STANDARD AND IF MANUFACTURER'S STANDARD IS PRIMER, THEN ON SITE PAINTING TO MATCH PIPEWORK

7.2.3 Double Block and Bleed Wedge Gate Valve Full Bore

SPECIFICATION: API 6D	**CLASS: 150**	**SIZE RANGE: DN 400 - DN600**
VALVE DESCRIPTION:	**FULL BORE TRUNNION MOUNTED DOUBLE BLOCK AND BLEED WEDGE GATE VALVE**	
	ANTISTATIC	
GENERAL:		
- FACE TO FACE DIM	MANUFACTURERS STANDARD PATTERN	
- BONNET/COVER FIXING	BOLTED	
- OPERATION	N/A	
- ELECTRIC MOTOR	N/A	
- FLANGE FINISH	RA 3.2 µm – 6.3 µm	
- SEALS	RENEWABLE	
- VALVE ORIENTATION	HORIZONTAL WITH STEM VERTICAL	
- ACTUATOR ORIENTATION	N/A	
MATERIAL:		
- BODY/BONNET/COVER	ASTM A216 WCB CARBON STEEL	
- PLUG	N/A	
- GLAND PACKING	GRAPHITE TYPE	
- BOLTING	ASTM A193 – GRB7 NUTS A194 GR2H BLACK	
- BONNET GASKET	MANUFACTURERS STANDARD	
- SEALS	VITON	
DESIGN CONDITIONS:		
- PRESSURE	ANSI B16.5 RATING	
- TEMPERATURE	10ºC TO 80ºC	
- SERVICE	AVIATION TYPE KEROSENE	
TEST:		
- HYDROSTATIC	BS 5146 / BS 6755	
- IMPACT	AS STANDARD	
CERTIFICATION:	PRESSURE CONTAINING PARTS TO DIN 50049.3.1B, NON PRESSURE	
	CONTAINING PARTS TO DIN 50049 TPYE 2.2. FIRE TEST TO API RP 6FA	
MATERIAL REQUIREMENTS:	CARBON CONTENT IS LIMITED TO 0.25%MAX (LADLE ANALYSIS) WITH CARBON EQUIVALENT LIMITED TO 0.45% MAX. USING FORMULA $CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$	

NOTES:

1. PROCEDURE AND RESULTS OF HYDROTESTING SHALL BE IN ACCORDANCE WITH API6 D.
2. NDE OF CASTINGS SHALL BE TO MSS.SP.55 WITH 10% SELECTED AT RANDOM TO ANSI B16.34 SECTION 8.
3. ALL VALVE BODIES SHALL HAVE A MINIMUM OF 1.5mm CORROSION ALLOWANCE
4. PAINTING: MANUFACTURER'S STANDARD AND IF MANUFACTURER'S STANDARD IS PRIMER, THEN ON SITE PAINTING TO MATCH PIPEWORK

7.2.4 Double Block and Bleed Plug Valve Standard Bore

SPECIFICATION: API 6D	**CLASS: 150**	**SIZE RANGE: DN200 - DN600**
VALVE DESCRIPTION:	**PLUG VALVE. NON-LUBRICATED, RETRACTING, RESILIENT SEAL, PERPENDICULAR WEDGE DESIGN, METAL TO METEL BACK-UP. DOUBLE BLOCK AND BLEED FIRE SAFE. STANDARD BORE**	
GENERAL:		
- FACE TO FACE DIM	MANUFACTURERS STANDARD	
- BONNET/COVER FIXING	BOLTED	
- OPERATION	MANUAL – HAND WHEEL OPERATED	
- ELECTRIC MOTOR	N/A	
- FLANGE FINISH	RA6.3 µm- 12.5 µm	
- SEALS	RENEWABLE	
- VALVE ORIENTATION	HORIZONTAL WITH STEM VERTICAL	
- ACTUATOR ORIENTATION	PERPENDICULAR TO STEM (ACTUATOR P.T.S. IN SECTION 27)	
MATERIAL:		
- BODY/BONNET/COVER	ASTM A216 WCB (BODY BORE CHROME PLATED)	
- PLUG	ASTM A216 WCB CHROME PLATED	
- GLAND PACKING	GRAPHITED TYPE	
- BOLTING	ASTM A193 – GRB7 NUTS A194 GR2H CADMUM PLATED	
- BONNET GASKET	MANUFACTURERS STANDARD	
- SEALS	VITON	
DESIGN CONDITIONS:		
- PRESSURE	ANSI B16.5 RATING	
- TEMPERATURE	10°C TO 80°C	
- SERVICE	AVIATION TYPE KEROSENE	
TEST:		
- HYDROSTATIC	BODY: 30 BARG SEAL: 22 BARG AIR SEAT/BODY: 7 BARG	
- IMPACT	AS STANDARD	
CERTIFICATION:	PRESSURE CONTAINING PARTS TO DIN 50049.3.1B, NON-PRESSURE CONTAINING PARTS TO DIN 50049 TYPE 2.2 FIRE TEST TO API RP 6FA.	
MATERIAL REQUIREMENTS:	CARBON CONTENT IS LIMITED TO 0.25%MAX (LADLE ANALYSIS) WITH CARBON EQUIVALENT LIMITED TO 0.45% MAX. USING FORMULA CE = $C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$	

NOTES:

1. VALVE SHALL BE FITTED WITH INTEGRAL CAVITY THERMAL RELIEF, LOCKABLE MANUAL BLEED, POSITION INDICATOR AND PLUGGED DRAIN.
2. PROCEDURE AND RESULTS OF HYDROTESTING SHALL BE IN ACCORDANCE WITH API6 D.
3. NDE OF CASTINGS SHALL BE TO MSS.SP.55 WITH 10% SELECTED AT RANDOM TO ANSI B16.34 SECTION 8.
4. ALL VALVE BODIES SHALL HAVE A MINIMUM OF 1.5mm CORROSION ALLOWANCE
5. PAINTING: MANUFACTURER'S STANDARD AND IF MANUFACTURER'S STANDARD IS PRIMER, THEN ON SITE PAINTING TO MATCH PIPEWORK

Appendix 3 Paint Mix Record

Each batch of coating shall be mixed to the manufacturer's instructions under the supervision of an inspector and the details of the mix recorded per the following table.

Manufacturer	
Coating Type	
Coating Name or Code No	
Thinness Code No	
Batch No Part 1	
Batch No Part 2	
Batch No Thinners	
Mix Ratio Part 1	litres
Part 2	
Thinners	
Date & Time of Mix	
Mix Observed By	
Ref No of Mix	

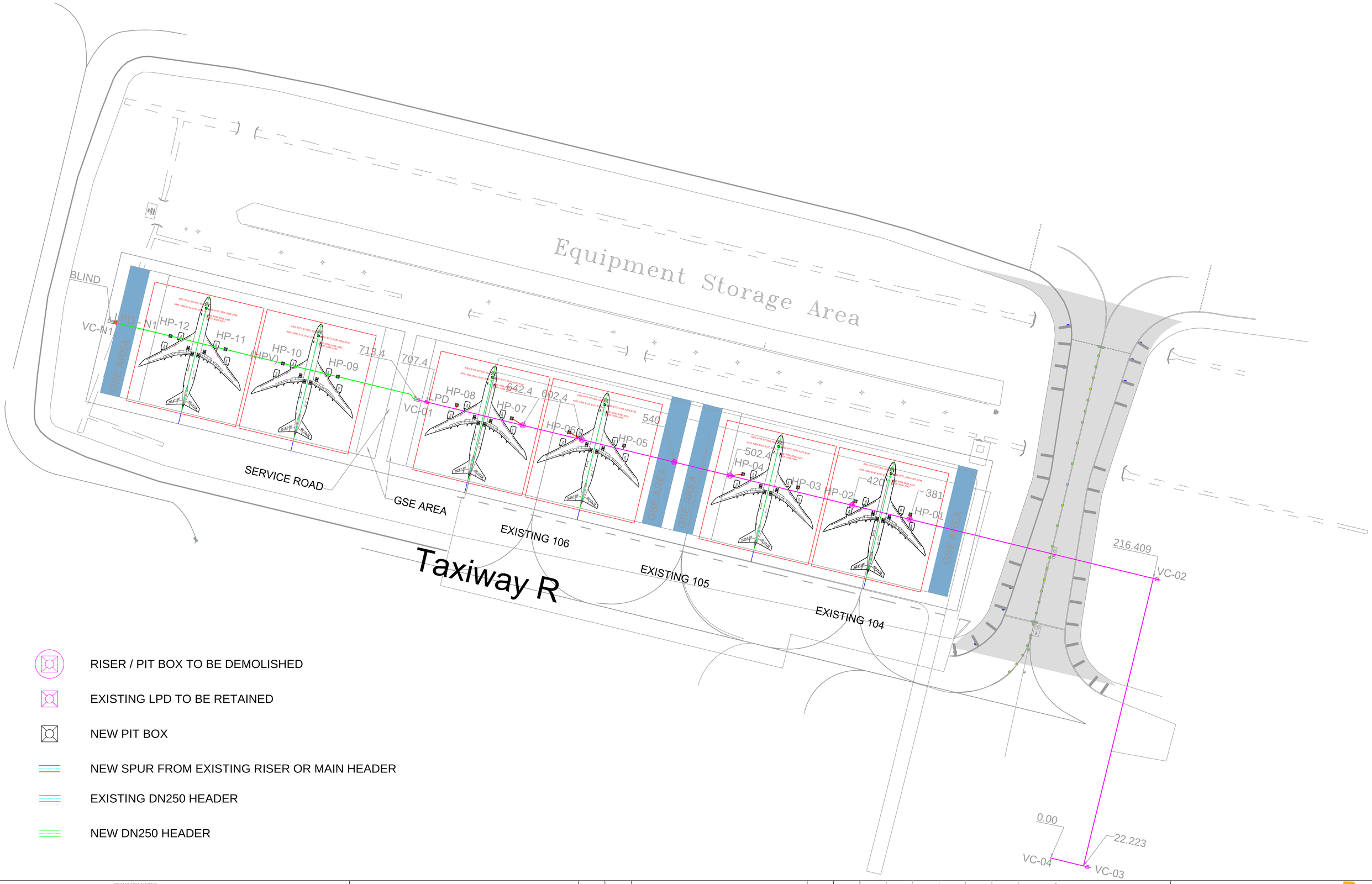
It shall be possible to relate the coating batch mix number to specific lengths of pipe.

DAFFPL

Let's fly high together !

END

DWG. No. P1101A-M-101 Sheet 1 of 1 | REV. 01



RISER / PIT BOX TO BE DEMOLISHED

EXISTING LPD TO BE RETAINED

NEW PIT BOX

NEW SPUR FROM EXISTING RISER OR MAIN HEADER

EXISTING DN250 HEADER

NEW DN250 HEADER

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN METERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
3. LOW POINT DRAINS AND HIGH POINT VENTS TO BE FITTED WITH FIRE SAFE BALL VALVE(S) AND APPROVED 1.5 INCH NB DRY BREAK COUPLING.
4. STAND BOUNDARY SHOWN HERE IS NOTIONAL ONLY
5. WHERE SPUR IS TAKEN OFF THE EXISTING RISER, NON-STANDARD ANGLE SHALL BE ACHIEVED USING STANDARD ELBOWS (ROLLED ELBOW)
6. CHAINAGES SHOWN HERE ARE NOTIONAL ONLY. CONTRACTOR TO SURVEY THE EXISTING PIPE PROFILE AND PROPOSE TIE-IN
7. BEFORE ANY MECHANICAL WORKS ARE INITIATED ON THE EXISTING PIPES, CONTRACTOR TO ENSURE THAT THE FUEL IS COMPLETELY DRAINED AND GAS FREED.
8. PLUG VALVE WITHIN THE NEW VALVE CHAMBER (VC-N1) SHALL BE BLINDED DOWNSTREAM FOR FUTURE CONNECTION. OPENING IN VALVE CHAMBER SHALL BE PROVIDED FOR FUTURE CONNECTION. OPENING SHALL BE APPROPRIATELY BLANKED SO THAT WATER INGRESS IS PREVENTED
9. CONTRACTOR SHALL PREPARE LONG SECTION DRAWING ADDRESSING ALL INTERFACES. A MINIMUM SLOPE OF 1:250 SHALL BE MAINTAINED
10. STAND CENTRE LINE SHOWN HERE IS NOTIONAL BASED ON REFERENCE DRAWING "Cargo apron 748 plan 51 (105-110)". CONTRACTOR TO VALIDATE AND ACCORDINGLY CONFIRM THE LOCATION OF HYDRANT PIT

REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE
P1101A-M-103 R1 - VALVE CHAMBER DETAIL DRAWING											
P1101A-M-104 R1 - STANDARD DETAIL DRAWING	01	07/12/18	INITIAL REVIEW FOR CLIENT	BJR	07/12/18	CB	07/12/18	CB	07/12/18		

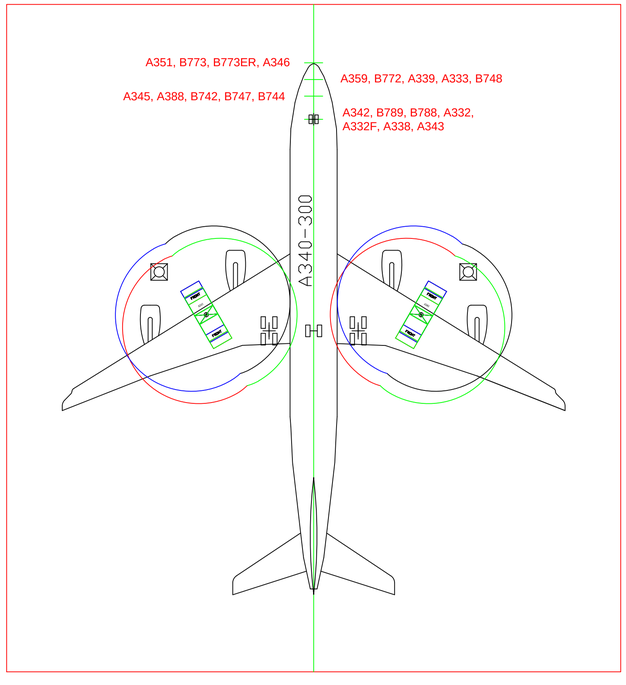
AvEn CONSULTANTS

PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

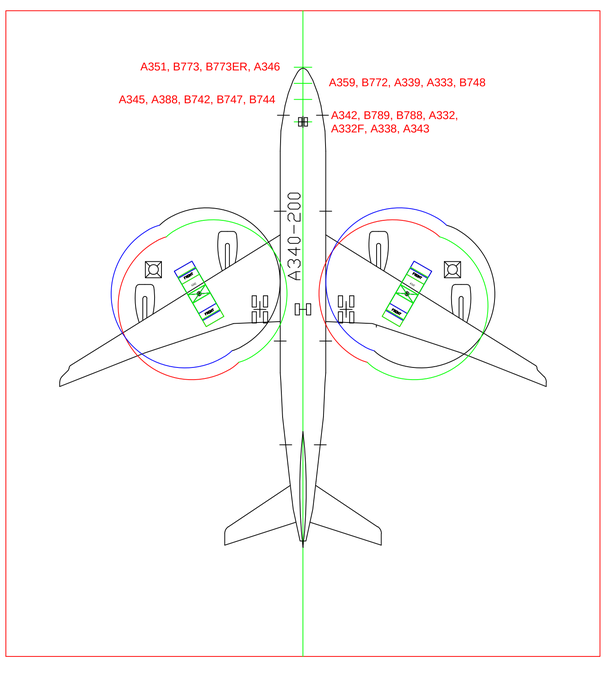
DAFFPL Let's fly high together !

TITLE: GENERAL ARRANGEMENT DRAWING

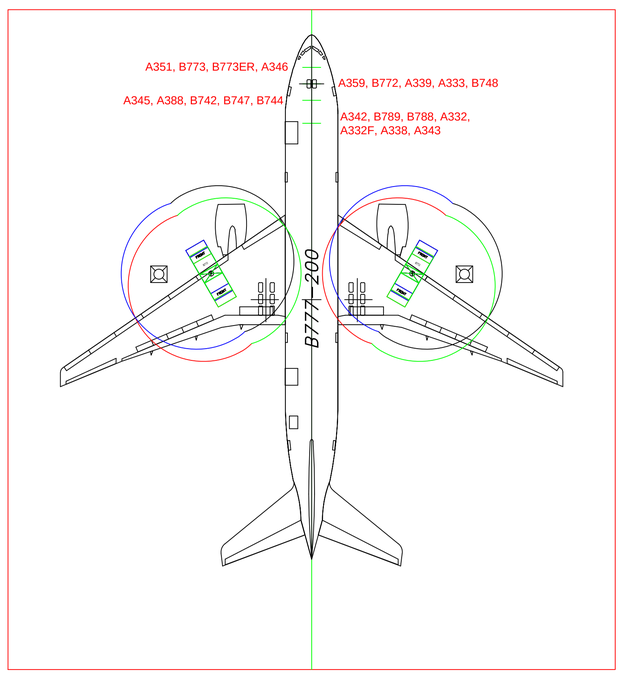
SCALE: 1.5:1 @ A1 | DRAWN BY: BJR | DATE: 07/12/18 | DWG. No P1101A-M-101 Sheet 1 of 1 | REV. 01



A 343



A 342



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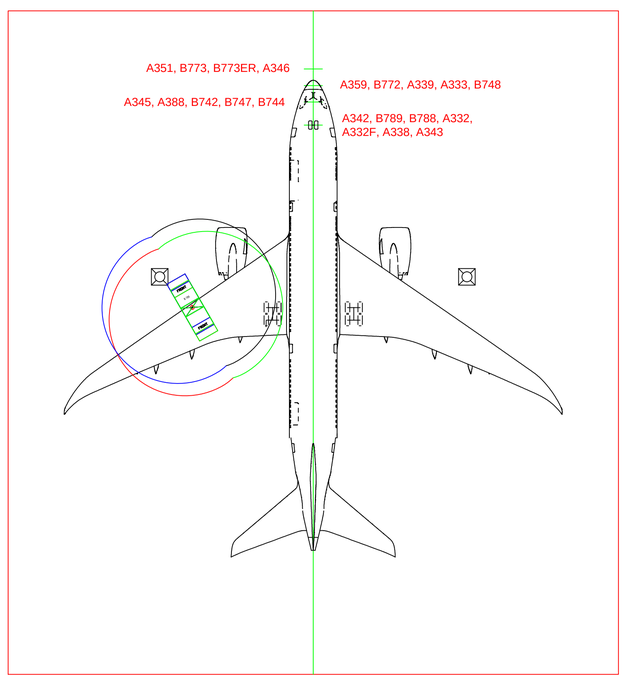

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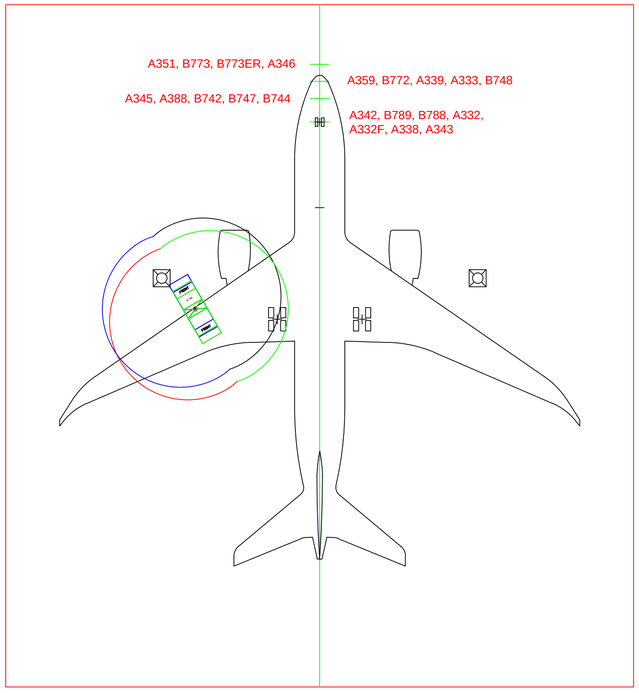

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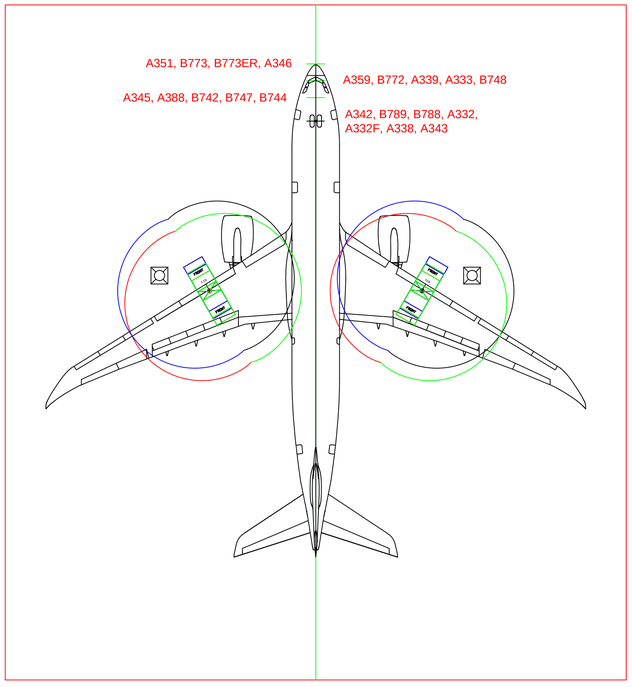

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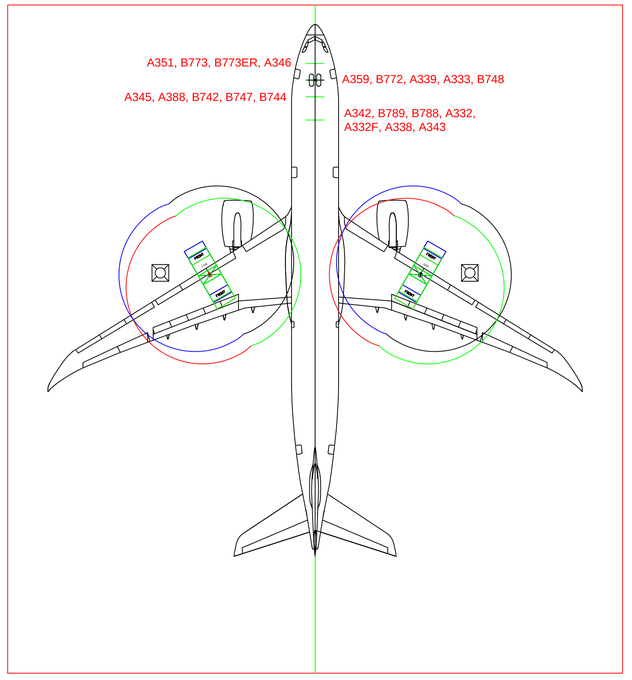

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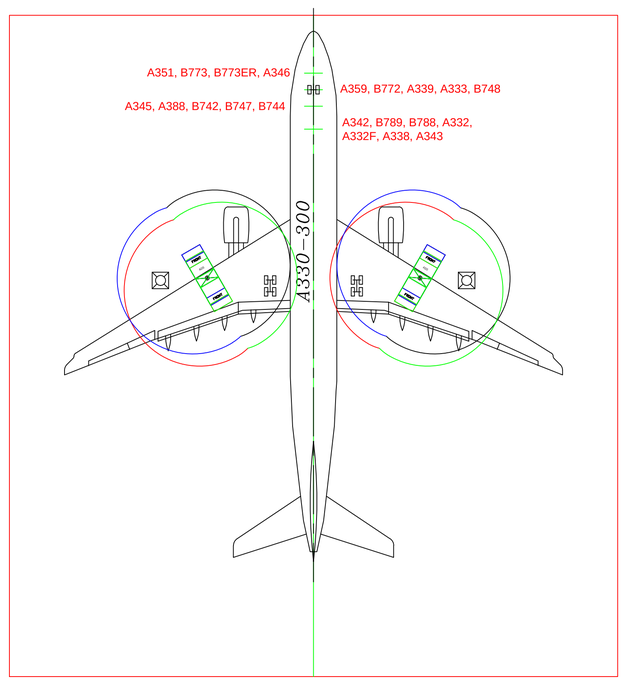

A 333

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN METERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
3. STANDARD HOSE LENGTH OF 9m IS CONSIDERED AND DISPENSER APPROACH IS CHECKED ACCORDINGLY. USAGE OF ANY OTHER HOSE LENGTH IN LIEU IS NOT VOUCHED IN THIS STUDY
4. TYPES OF AIRCRAFTS CONSIDERED HERE ARE GENERIC CODE E AND CODE F AIRCRAFTS. SPECIFIC REQUIREMENTS SHALL BE OBTAINED FROM OPERATIONS TEAM AND REFUELING STUDY TO BE REDONE BY THE CONTRACTOR AND LOCATION OF HYDRANT PIT TO BE DETERMINED.
5. ONLY CODE E AND CODE F AIRCRAFTS ARE CONSIDERED HERE. NO CODE D AIRCRAFTS ARE CONSIDERED. IF INSTRUCTED BY CLIENT, CONTRACTOR TO INCLUDE THE SAME IN THE REFUELING STUDY
6. ONCE WHEN THE LOCATION OF THE HYDRANT PIT IS FINALISED IN INDIVIDUAL STAND, THE SAME SHALL BE SUPERIMPOSED IN OVERALL LAYOUT TO CONCLUDE THE PIPE ROUTING
7. FOR A388, WITH 80m WING SPAN, MINIMUM CLEARANCE OF 7.5M TO ADJACENT AIRCRAFT CANNOT BE ACHIEVED WITH THE CURRENT STAND CONFIGURATION. THEREFORE, EITHER THE STAND NEED TO BE RECONFIGURED OR A388 CANNOT BE ENVISAGED FOR REFUELING
8. ALL CODE E & CODE F AIRCRAFTS ARE REFUELED BY UNDERWING FUELING.
9. LEGEND :
   SO - STAND OFF FUELING
   UW - UNDERWING FUELING

P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	03/12/18	INITIAL REVIEW FOR CLIENT	BJR	03/12/18	CB	03/12/18	CB	03/12/18		
REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE

AvEn CONSULTANTS

PROJECT:
DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

DAFFPL
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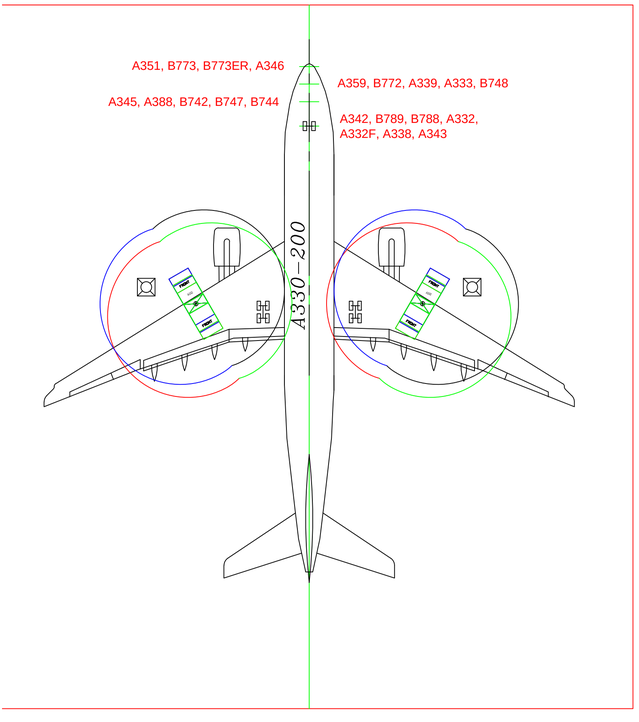
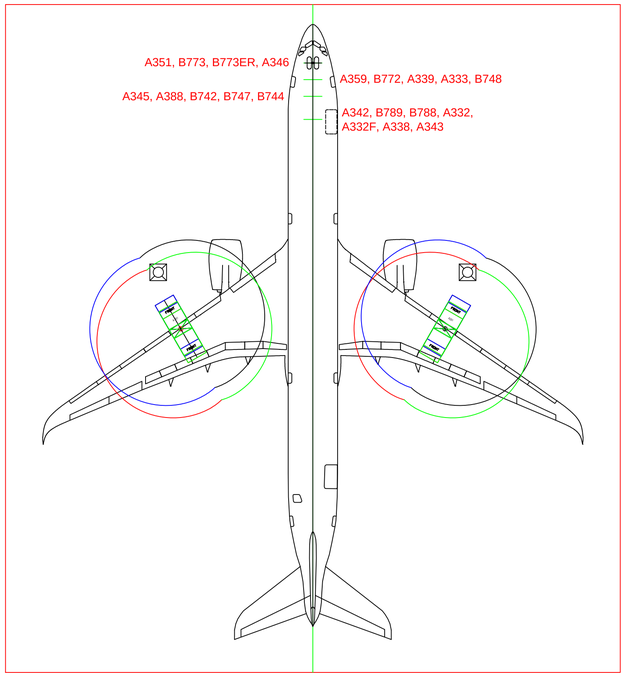
TITLE:
Refueling Study of Code E & Code F Aircrafts

SCALE: NTS | DRAWN BY: BJR | DATE: 03/12/18 | DWG. No P1101A-M-102 Sheet 1 of 3 | REV. 01



A 332 & A332F



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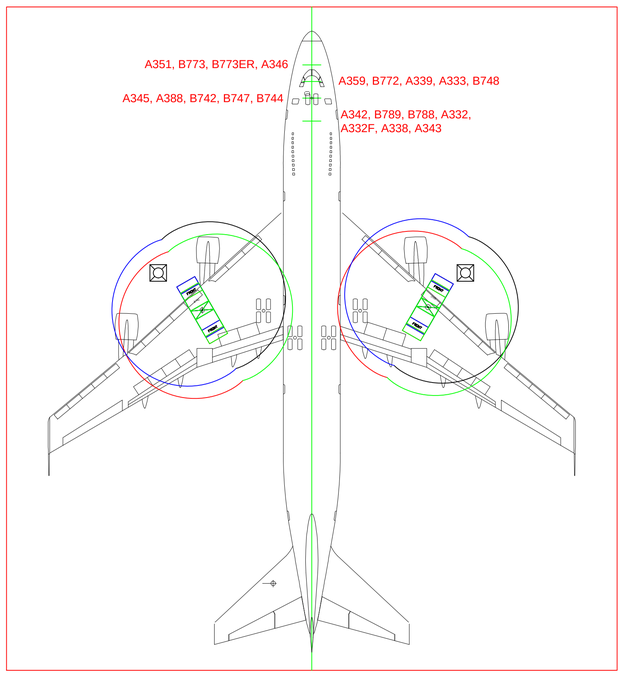

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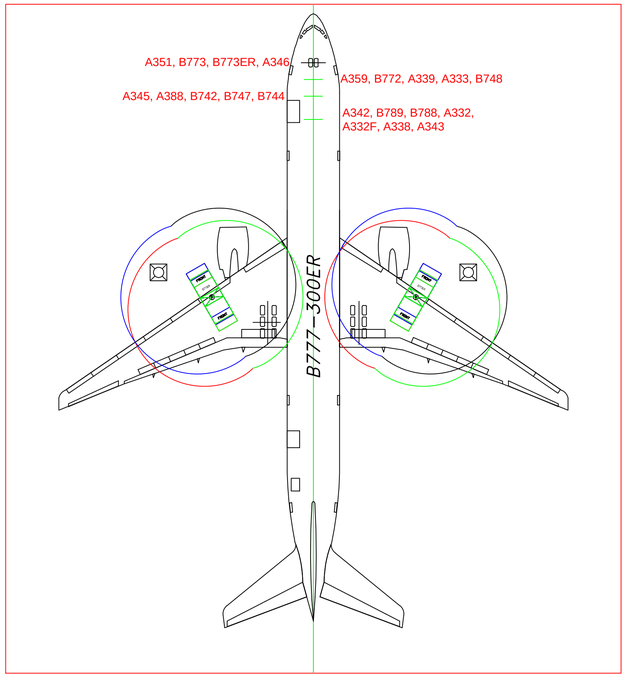

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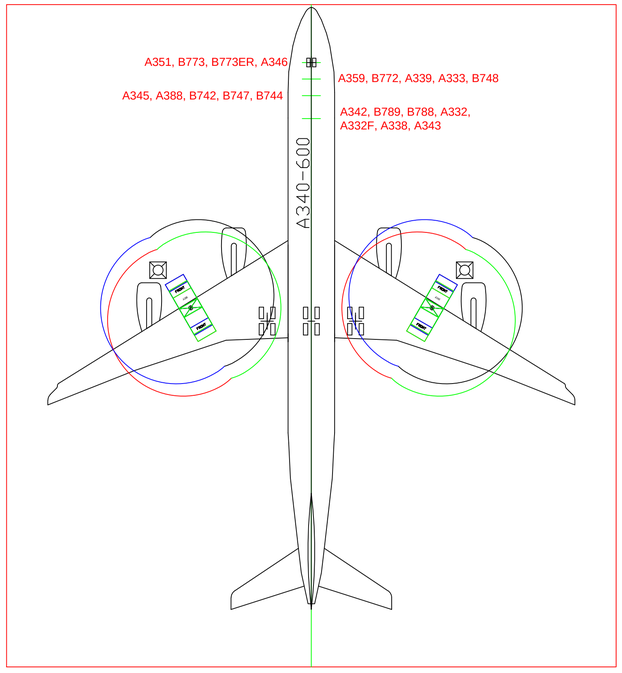

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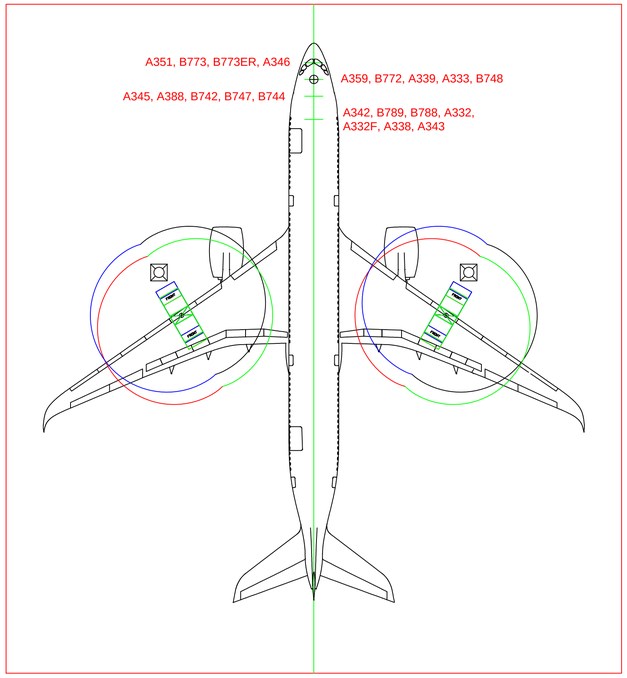

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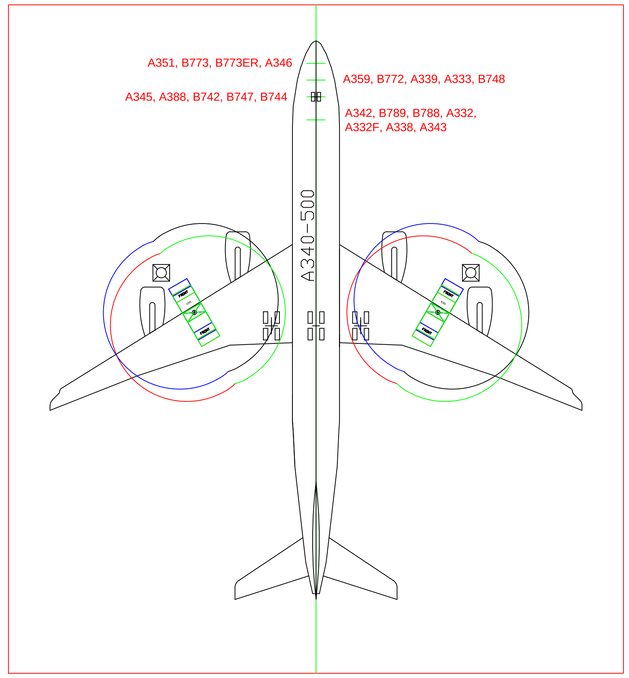

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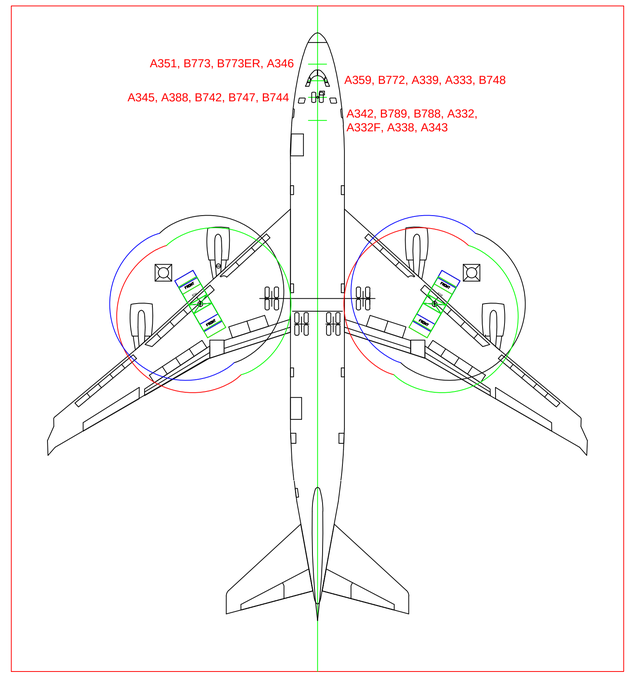

B747 & B744

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN METERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
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9. LEGEND :
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REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE
P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	03/12/18	INITIAL REVIEW FOR CLIENT	BJR	03/12/18	CB	03/12/18	CB	03/12/18		

AvEn CONSULTANTS

PROJECT:
DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

DAFFPL
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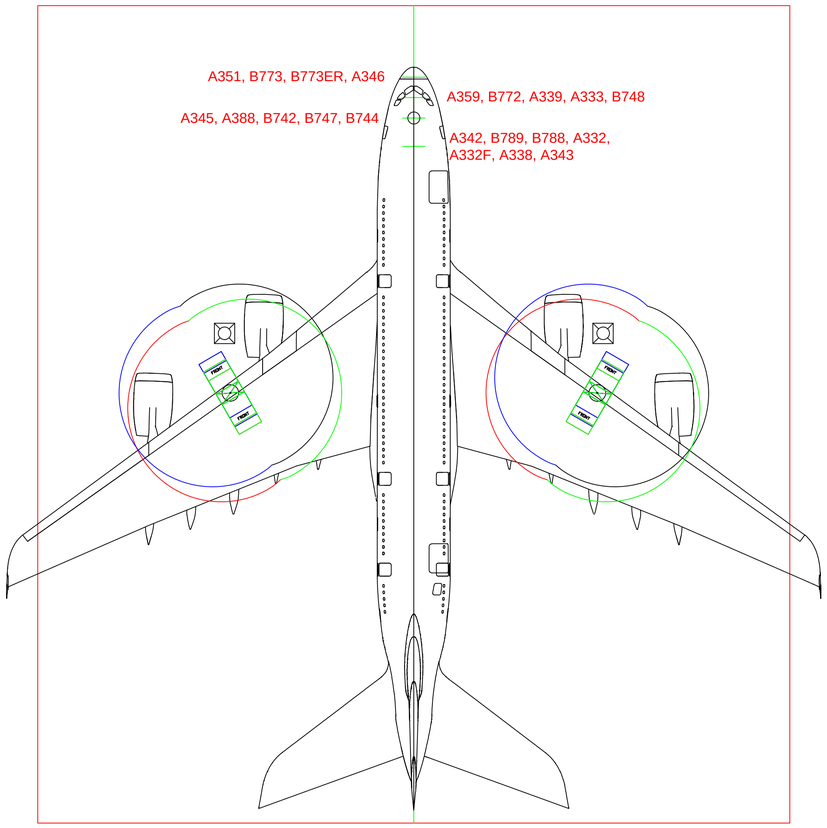
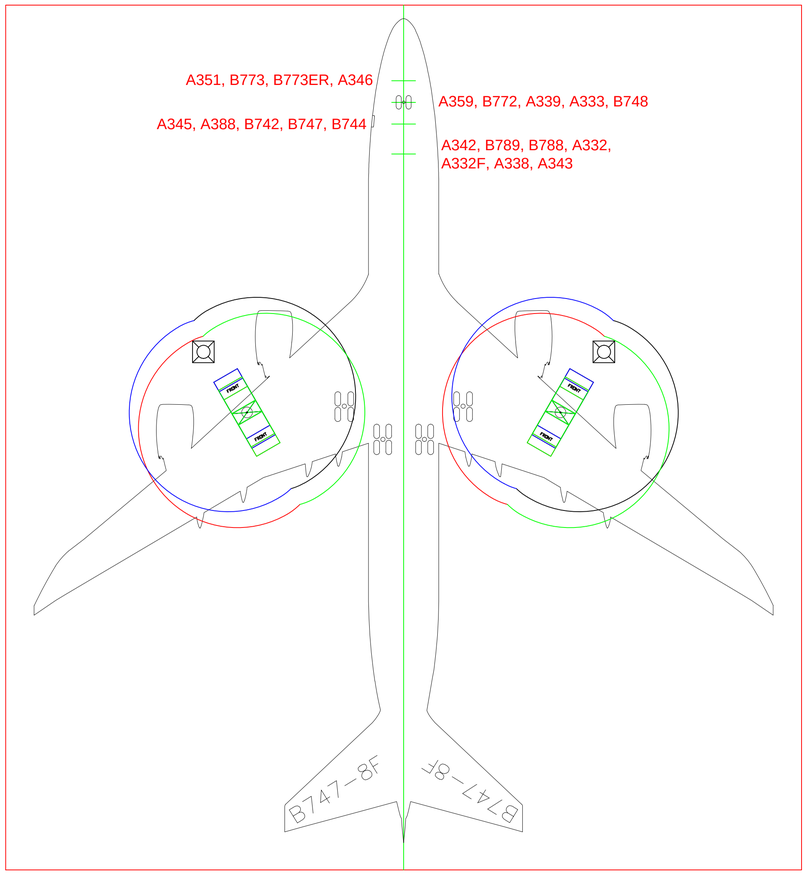
TITLE:
Refueling Study of Code E & Code F Aircrafts

SCALE: NTS | DRAWN BY: CB | DATE: 03/12/18 | DWG. No P1101A-M-102 Sheet 2 of 3 | REV. 01



A388
(REFER NOTE-7)



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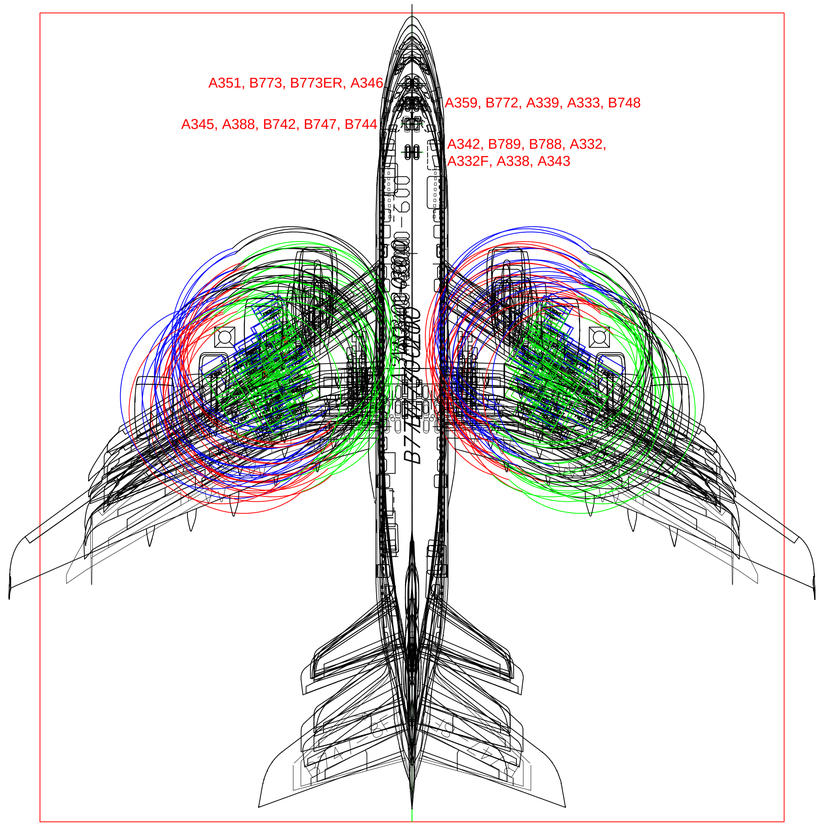

TYPICAL CODE-E & TYPICAL CODE-F

STANDARD NOTES

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P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	03/12/18	INITIAL REVIEW FOR CLIENT	BJR	03/12/18	CB	03/12/18	CB	03/12/18		
REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE

AvEn CONSULTANTS

PROJECT:
DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

DAFFPL
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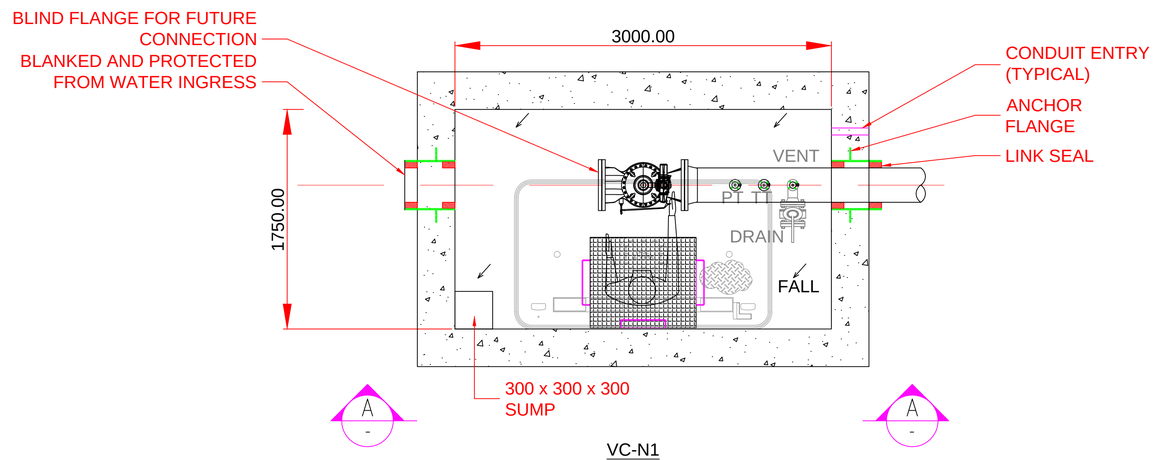
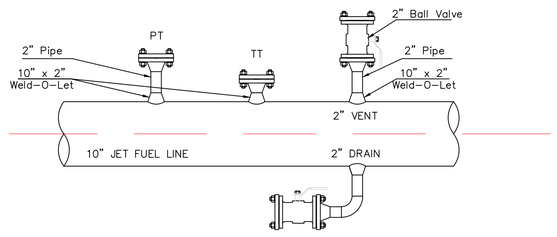
TITLE:
Refueling Study of Code E & Code F Aircrafts

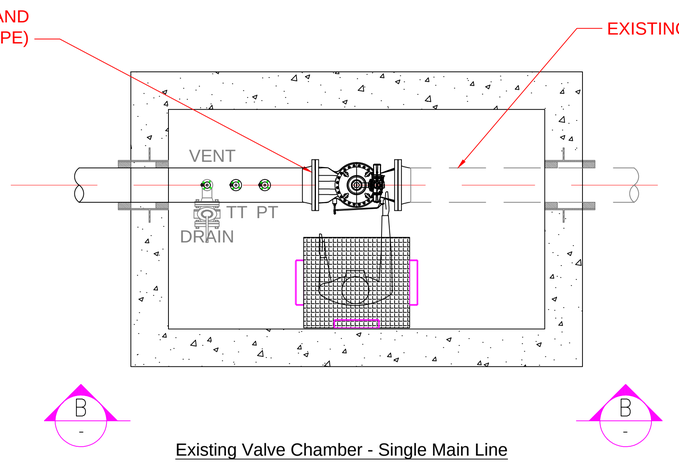
SCALE: NTS | DRAWN BY: CB | DATE: 03/12/18 | DWG. No P1101A-M-102 Sheet 3 of 3 | REV. 01



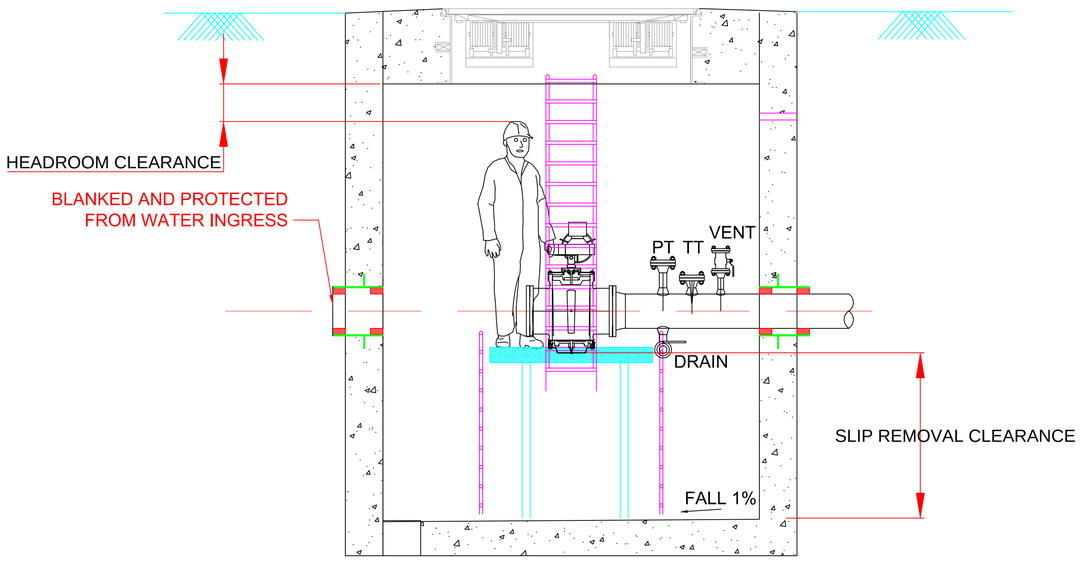
VC-N1
Typical Plug Valve Chamber - Single Main Line



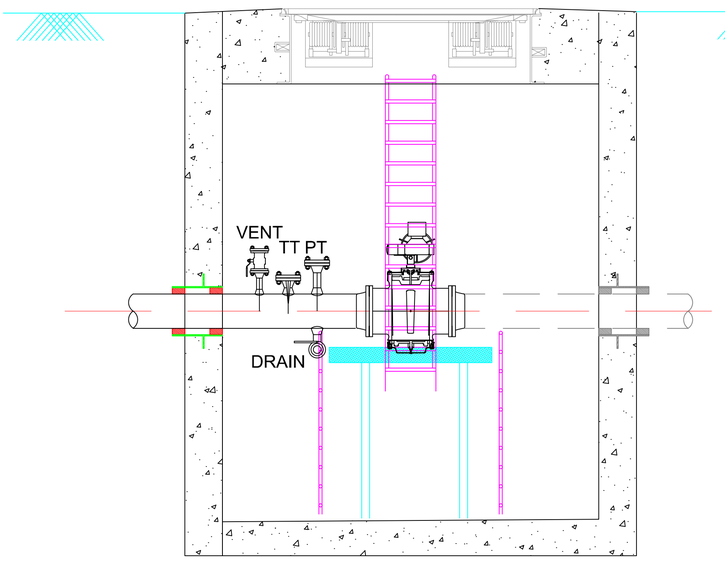
TYPICAL DETAILS OF DRAIN, VENT AND INSTRUMENTATION ON 10" JET FUEL LINE (ALL MATERIALS FOR INSTRUMENT STUB ARE OF CONTRACTOR'S SCOPE AND INSTRUMENTS ARE NOT PART OF CONTRACTOR'S SCOPE)



Existing Valve Chamber - Single Main Line



SEC A-A (TYPICAL FOR INFO)



SEC B-B (TYPICAL FOR INFO)

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
3. ACCESS WITHIN VALVE CHAMBER SHALL BE PROVIDED WITH PERMANENT ARRANGEMENT.
4. SLIP REMOVAL CLEARANCE SHALL BE MAINTAINED
5. HEAD ROOM CLEARANCE SHALL BE MAINTAINED
6. ACCESS PLATFORM SHALL BE POSITIONED IN A MANNER THAT VALVE HANDLE IS OPERABLE.
7. ACCESS TO DTR (DIFFERENTIAL THERMAL RELIEF) VALVE SHALL BE PROVIDED.
8. CHAMBER FLOOR SHALL SLOPE TOWARDS THE SUMP
9. OPENING SHALL BE PROVIDED IN THE VALVE CHAMBER FOR THE PIPE CONNECTION IN THE FUTURE. OPENING SHALL BE BLANKED AND PROTECTED FROM WATER INGRESS

REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY		CHKD BY				Client Appr.	
P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	07/12/18	INITIAL REVIEW FOR CLIENT	BJR		CB		CB			

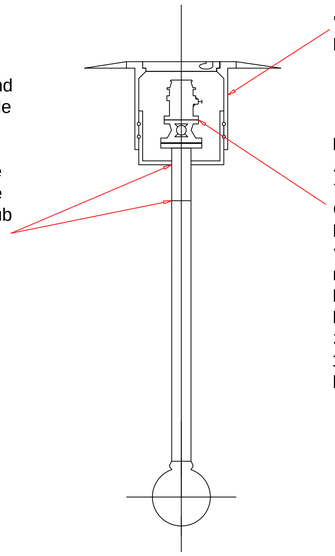
PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

Let's fly high together !

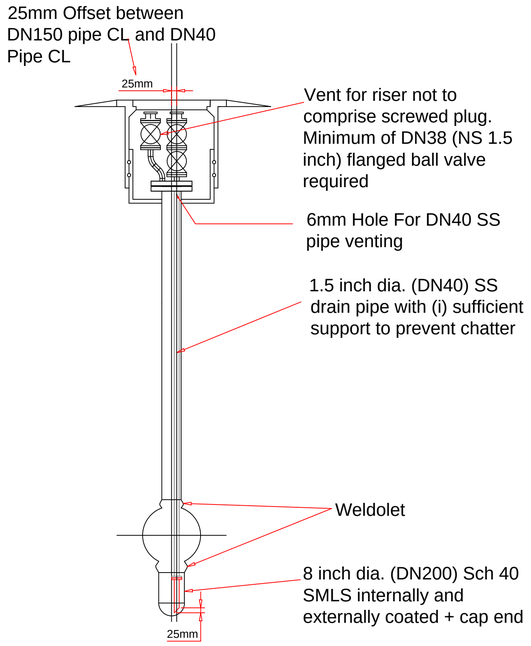
TITLE: Valve Chamber Detailed Drawing (VC-N1)

SCALE: NTS	DRAWN BY: BJR	DATE: 07/12/18	DWG. No P1101A-M-103 Sheet 1 of 1	REV. 01

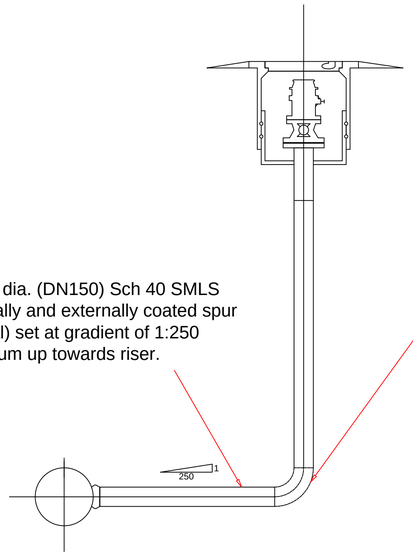
In case where riser stub and pit box are integral as single vendor supply unit, entire riser assembly will be subject to full test pressure i.e. it will not be acceptable to classify main riser-to-stub butt weld as Non-Pressure Tested Closure Weld ("Golden Weld") and avoid such pressure test. Contractor to make due allowance in construction and pre-commissioning planning.



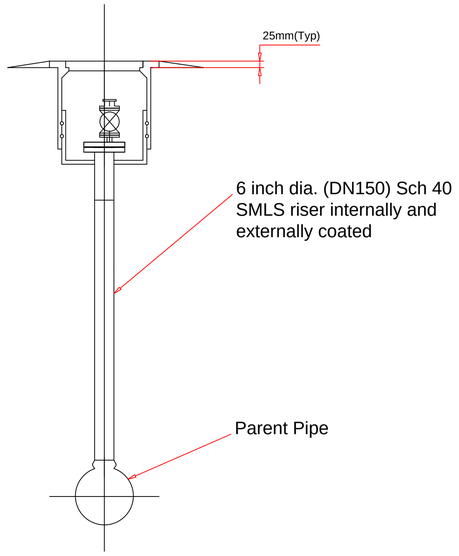
Hydrant Pit Type A



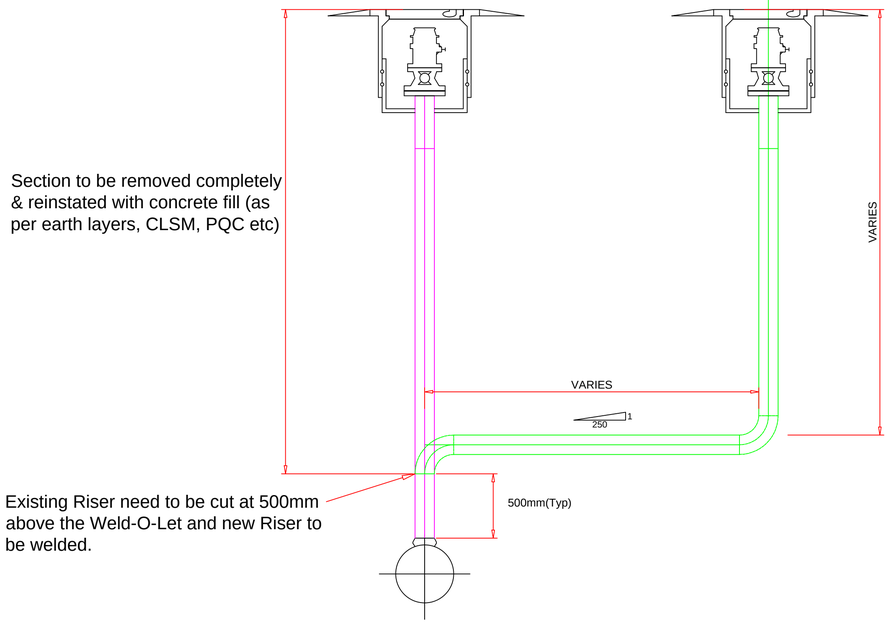
Low Point Drain



Hydrant Pit Type B



High Point Vent



Hydrant Pit Type C

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
3. LOW POINT DRAINS AND HIGH POINT VENTS TO BE FITTED WITH FIRESAFE BALL VALVE(S) AND APPROVED 1.5 INCH NB DRY BREAK COUPLING.
4. A TYPICAL HYDRANT PIT CAN BE USED AS A HIGH POINT VENT IF THE PIPE PROFILE MATCHES THE HIGHEST POINT

REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE
P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	07/12/18	INITIAL REVIEW FOR CLIENT	BJR	07/12/18	CB	07/12/18	CB	07/12/18		

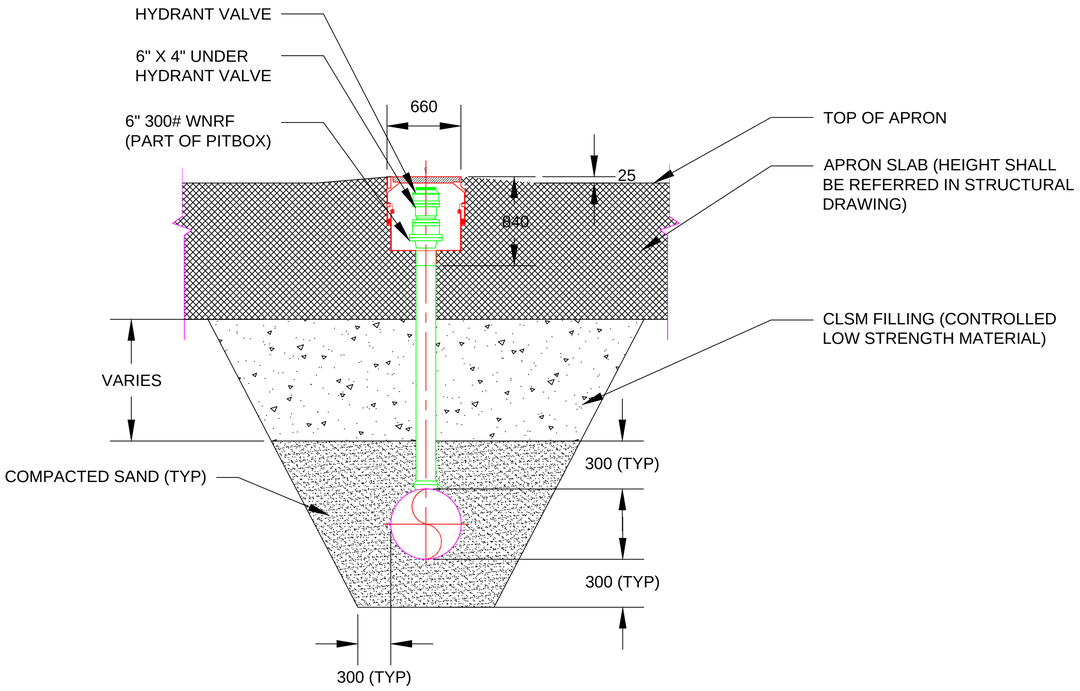
SCALE: NTS | DRAWN BY: BJR | DATE: 07/12/18

PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

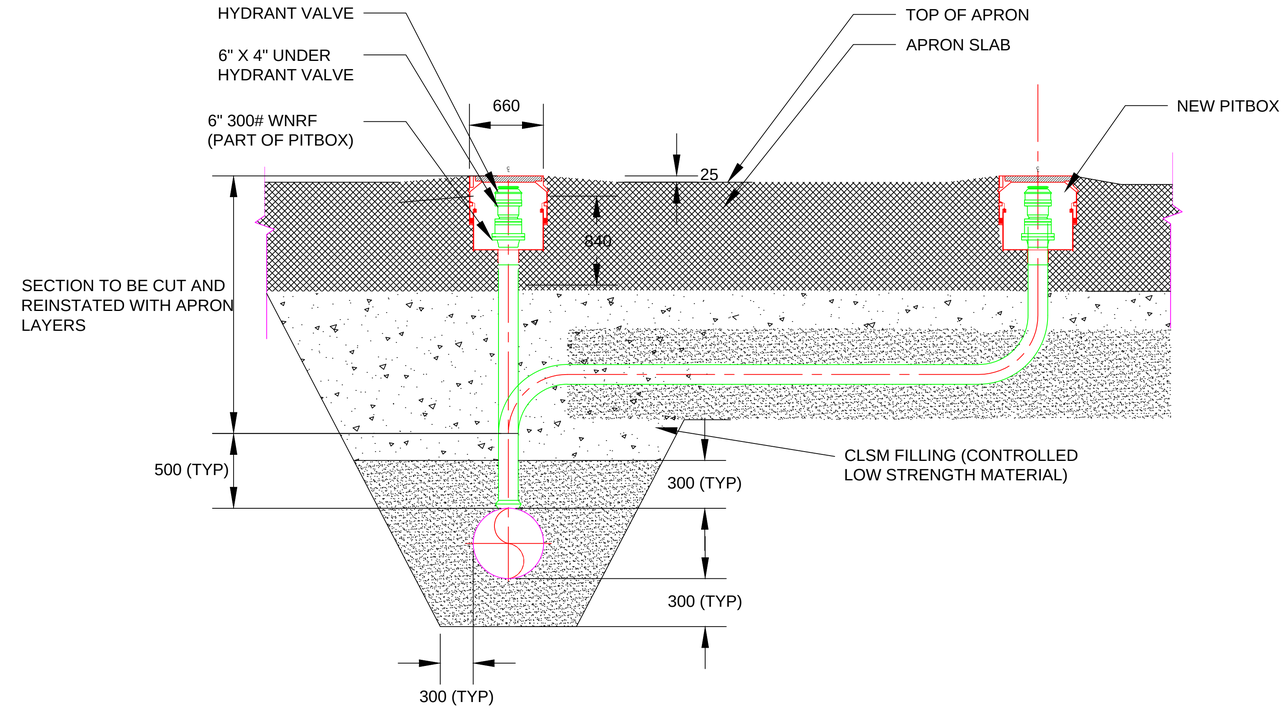
Let's fly high together !

TITLE: Hydrant Pit, LPD, HPV Drawing of Fuel Hydrant System

DWG. No P1101A-M-104 Sheet 1 of 1 | REV. 01



TYPICAL RISER



TYPICAL RISER WITH CUT SECTION TO CONNECT TO NEW HYDRANT PIT BOX

STANDARD NOTES

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2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
3. HEADER AND SPUR PIPE SHALL HAVE COMPACTED SAND SURROUND OF 300mm
4. HEIGHT OF CLSM VARIES DEPENDS ON THE DEPTH OF PIPE HEADER. IT IS THE RESPONSIBILITY OF THE HYDRANT CONTRACTOR TO BACKFILL UP TO THE BOTTOM OF THE PQC (APRON SLAB) WITH CLSM
5. TYPE OF EXCAVATION SHALL BE CONFIRMED BY THE CIVIL CONSULTANT/CONTRACTOR. IN THE EVENT OF ANGULAR TRENCH, THE SLOPE SHALL BE 0.5:1m (i.e. 0.5 HORIZONTAL : 1 VERTICAL)
6. WHERE EXISTING RISER NEED TO BE CUT, A DISTANCE OF 500mm SHALL BE MAINTAINED FROM THE TOP OF THE PIPE TO THE CUT SECTION.
7. PIT BOXES SHALL BE PROTRUDED BY 25mm ABOVE THE SURFACE TO PREVENT WATER INGRESS. A GRADUAL SLOPE SHALL BE MAINTAINED IN ORDER TO AVOID THE GSE VEHICLES DAMAGING THE PIT BOX SURFACE

P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	07/12/18	INITIAL REVIEW FOR CLIENT	BJR	07/12/18	CB	07/12/18	CB	07/12/18		
REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE

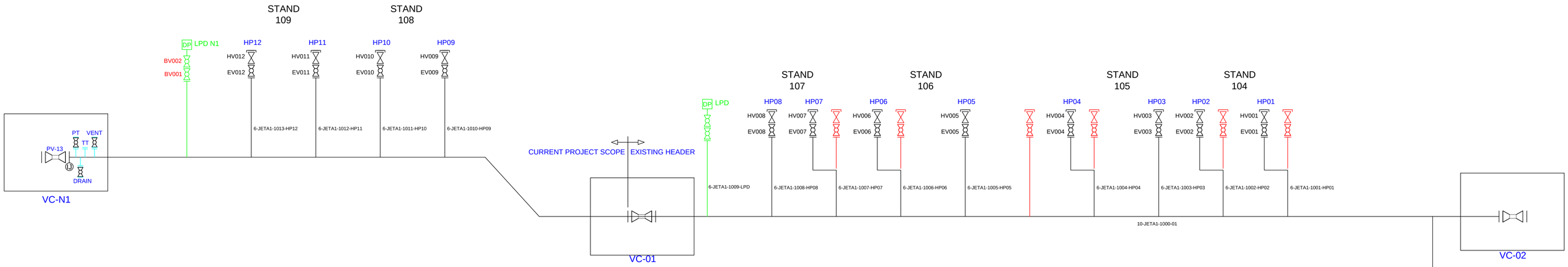
AvEn CONSULTANTS

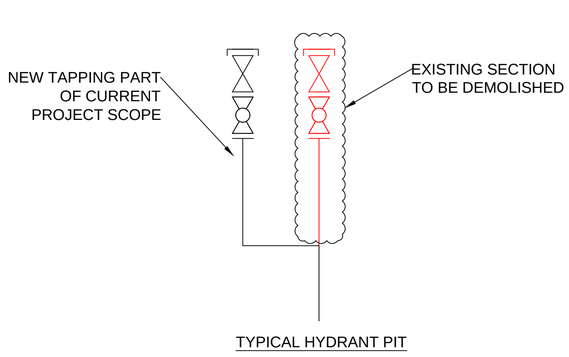
PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

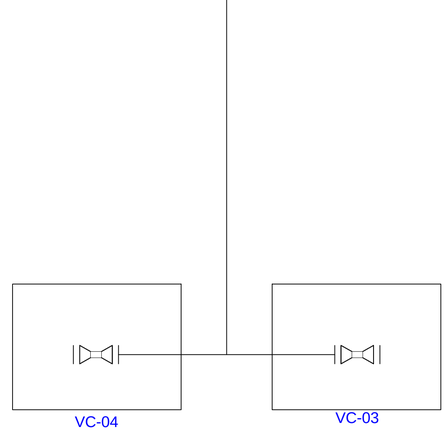
DAFFPL Let's fly AigA together !

TITLE: TYPICAL TRENCH CROSS SECTION

SCALE: NTS | DRAWN BY: BJR | DATE: 07/12/18 | DWG. No P1101A-M-105 Sheet 1 of 1 | REV. 01







BV	Fire-Safe Ball Valve
HV	Hydrant Pit Valve
LP	Low Point Drain
EV	Under Hydrant Emergency Valve

LEGEND

STANDARD NOTES

1. STANDARD P&ID SYMBOLS ARE APPLICABLE.
2. TYPE OF VALVE SHOWN IN VC-01 TO VC-04 ARE NOTIONAL. VALVE IN VC-N1 IS A PLUG VALVE
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH EMPLOYER'S REQUIREMENT
4. LOW POINT DRAINS AND HIGH POINT VENTS TO BE FITTED WITH FIRESAFE BALL VALVE(S) AND APPROVED 1.5 INCH NB DRY BREAK COUPLING.
5. SCOPE BREAK SHOWN HERE IS JUST TO REPRESENT THE LIMITS OF EXISTING HEADER AND START OF NEW HEADER. THE OVERALL SCOPE INCLUDES MODIFICATION OF HEADER AND RISER WITHIN THE EXISTING BOUNDARY TOO.

REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE
P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	07/12/18	INITIAL REVIEW FOR CLIENT	BJR	07/12/18	CB	07/12/18	CB	07/12/18		

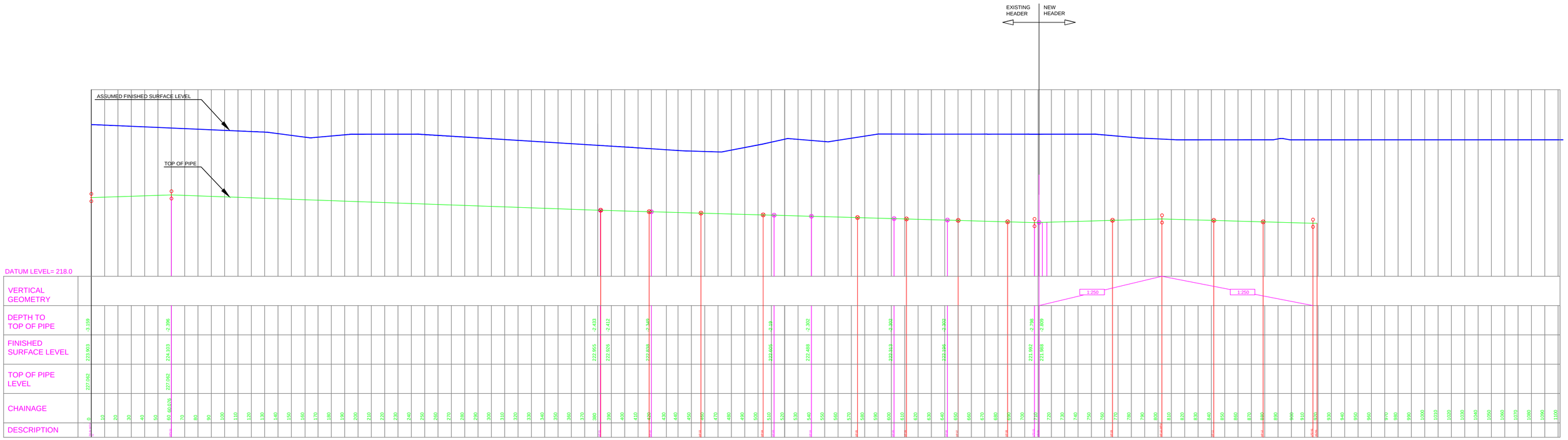
PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

Let's fly high together !

TITLE: Process & Instrumentation Diagram

SCALE: NTS | DRAWN BY: BJR | DATE: 07/12/18

DWG. No. P1101A-M-107 Sheet 1 of 1 | REV. 01



SCALE HORIZ 1 : 1000 metres
VERT 1 : 100 metres

EXISTING RISER TO BE DEMOLISHED AND CONNECTED TO NEW RISER

NEW RISER CONNECTING TO EXISTING HEADER/RISER AND ALSO NEW HEADER

STANDARD NOTES

1. ALL DIMENSIONS STATED HERE ARE IN METERS UNLESS OTHERWISE SPECIFIED
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH GENERAL ARRANGEMENT DRAWINGS EMPLOYER'S REQUIREMENT
3. PROFILE OF EXISTING HEADER AND NEW HEADER SHOWN HERE ARE NOTIONAL
4. GPR (GROUND PENETRATION RADAR) SURVEY SHALL BE DONE BEFORE ANY EXCAVATION IS MADE AND ACCORDINGLY PIPE LEVELS SHALL BE DETERMINED
5. CONTRACTOR TO CHECK HORIZONTAL AND VERTICAL INTERFACE
6. AS PER ASME B 31.4, THE MINIMUM COVER OVER THE PIPE IS 1.2m IN PAVED AREAS. AS GOOD ENGINEERING PRACTICE MINIMUM 1.5m COVER SHALL BE ENSURED ALWAYS
7. APRON LEVELS FOR THE ALIGNMENT OF THE PIPE IS UNAVAILABLE, THEREFORE APRON LEVELS ARE INTERPOLATED. LEVELS SHOWN HERE ARE INDICATIVE, IT CAN BE INFLUENCED BY THE PRECISE APRON LEVELS, GRAVITY FED UNDERGROUND SERVICES ETC. CONTRACTOR TO CHECK THE INTERFACE AND PROPOSE CONSTRUCTION DRAWINGS ACCORDINGLY
8. CONTRACTOR SHALL ENSURE A MINIMUM SLOPE OF 1:250 UNLESS OTHERWISE INFLUENCED BY INTERFACE SERVICES

REFERENCE DRAWINGS	REV	DATE	REVISION DETAILS	DRAWN BY	DATE	CHKD BY	DATE	AvEn Appr.	DATE	Client Appr.	DATE
P1101A-M-101 R1 - GENERAL ARRANGEMENT DRAWING	01	16/12/18	INITIAL REVIEW FOR CLIENT	BJR	16/12/18	CB	16/12/18	CB	16/12/18		

SCALE: NTS | DRAWN BY: CB | DATE: 16/12/18

PROJECT: DELHI INTERNATIONAL AIRPORT - CARGO EXPANSION

TITLE: Long Sections Drawing

DWG. No P1101A-M-107 Sheet 1 of 1 | REV. 01

DAFFPL Let's fly AiGA together

LONG LEAD TIME ITEMS (Package 1: Linepipe and Fittings)				
Sr. No.	**Description**	**Unit**	**Quantity**	**Clarifications / Notes**
101	Linepipe DN250 (10 inch NPS) Carbon steel API 5L Grade B LSAW or ERW 9.27 mm WT (Sch STD). Single Random Lengths (6m each).	m	230	Quantity Offtake = actual requirement of +/- 208m + 10% qualification etc. To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements and externally HDPE coated in compliance with DIN30670. Internal and External coating shall be mill coated.
102	Linepipe DN200 (8 inch NPS) Carbon steel API 5L Grade B SMLS 8.18 mm WT (Sch STD). Single Random Lengths (6m each).	m	6	Quantity Offtake = 1 Single Random Length for fabrication of low point drain sumps + qualification etc. To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements and externally HDPE coated in compliance with DIN30670. Internal and External coating shall be mill coated. Or if any surplus stock is available with DAFFPL the same can be checked for fitness and reused
103	Linepipe DN150 (6 inch NPS) Carbon steel API 5L Grade B SMLS 7.11 mm WT (Sch STD).Single Random Lengths.	m	84	Quantity Offtake = actual requirement of +/- 77m + 10% for qualification etc. (Considering that none of the existing pipe can be reused and considered 3m as average depth of new risers and 2.5m for existing) To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements and externally HDPE coated in compliance with DIN30670. Internal and External coating shall be mill coated. Or if any surplus stock is available with DAFFPL the same can be checked for fitness and reused
104	Linepipe DN40 (1½ inch NPS) Stainless steel ASTM A312 TP316L SMLS Sch 40. Single Random Lengths.	m	6	Required for Low Point Drain. Or if any surplus stock is available with DAFFPL the same can be checked for fitness and reused
105	Butt Weld Bend 90 degree DN150 (6 inch NPS) Carbon steel ASTM A234-WPB 3D radius 7.11 mm WT.	Nos	13	Quantity Offtake = actual requirement of 13 +2 spare. To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements and externally HDPE coated in compliance with DIN30670.
106	Butt Weld Bend 45 degree DN250 (10 inch NPS) Carbon steel ASTM A234-WPB 3D radius 9.27 mm WT.	Nos	2	To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements and externally HDPE coated in compliance with DIN30670.
107	Butt Weld End Cap DN200 (8 inch NPS) wrought Carbon steel ASTM A234-WPB EXTRA STRONG Sch 80 ANSI B16.9.	Nos	1	For fabrication of low point drain sumps. To be internally epoxy coated (amine aduct cured epoxy) in compliance with EI 1541 & JIG 2 requirements.
108	Weld neck flange DN250 (10 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	Nos	2	One to connect to the existing VC and one another to connect to the new PV in VC-N1
109	Blind flange DN250 (10 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	Nos	1	To Blind the new PV (for future expansion) in VC-N1
110	Weldolet size Run DN250 (10 inch NPS) x Branch DN200 (8 inch NPS) ASTM A234-WPB Sch STD	Nos	1	1 for new LPD
111	Weldolet size Run DN250 (10 inch NPS) x Branch DN150 (6 inch NPS) ASTM A234-WPB Sch STD	Nos	9	3 on new header, 2 on existing, 1 spare.
112	General Requirement: Line pipes & fittings greater than 100mm shall be Internally epoxy coated in compliance with JIG 2 requirement & External HDPE coating in compliance with DIN30670. Line pipe and fittings 100mm and below shall be stainless steel			
113	Cathodic Protection System	lump sum	1	Overall Design, Procurement, Supply, Installation, Testing & Commissioning are part of current scope. Contractor to determine Quantity Offtake accordingly for Temporary (During Construction Phase) & Permanent CP system
114	ESD System (Emergency Shutdown system)	lump sum	1	Overall Design, Procurement, Supply, Installation, Testing & Commissioning are part of current scope

Note :

1. Typical quantities for DN250 (10 Inch NPS) for header & DN150 (6 Inch NPS) riser/spur lines are shown here,
2. Material Take Off for sizes DN 100 (4 Inch NPS) and below are to be accounted by the contractor and supplied. Any temporary piping, valves, fittings etc for construction, testing & commissioning shall be accounted by contractor and supplied.
3. Provision for Installation of Pressure and Temperature transmitter shall be made in VC-N1. Typical sizes shall be noted in valve chamber detail drawing. The sizes of such stubs are less than 4 Inch NPS and therefore contractor to arrive at the quantity, supply and install.
4. Quantities shown here are not exhaustive. Contractor to price for all the required quantities foreseeing the detail design.
5. To be read in conjuction with Employer's Requirements.
6. Cathodic Protection System, Emergency Shutdown Systems' design, procurement, installation, testing and commissioning are part of contractor's scope of supply.

300) LONG LEAD TIME ITEMS - Package 3: Double Block and Bleed Valves				
Sr. No.	**Description**	**Unit**	**Quantity**	**Clarifications / Notes**
301	Double Block and Bleed Valve DN250 (10 inch NPS) forged. Over-riding requirement is that all wetted parts must be compatible with Aviation Fuel Jet A-1 and vendor to ensure and warrant the same. Any factory-applied preservatives or coatings to be disclosed and instructions provided to enable this to be adequately removed prior to wetting with Aviation Fuel Jet A-1 in order to avoid risk of fuel contamination.	Nos	1	

Sr. No.	**Description**	**Specification Requirement**
301	**General**	
	Nominal Size	**DN 250 (10")**
	Face To Face Dimension	Manufacturer's standard
	Bonnet/Cover Fixing	Bolted
	Operation	Manual. Yet installation of Motor at a later stage shall be compatible
	Flange Finish	RA6.3 µm- 12.5 µm
	Seals	Renewable
	Valve Orientation	Horizontal with stem vertical
	Actuator Orientation	NA
	Material	
	Body/Bonnet/Cover	ASTM A216 WCB (Body Bore Chrome Plated)
	Plug	ASTM A216 WCB Chrome Plated
	Gland Packing	Graphited Type
	Gland Material	
	Bolting	ASTM A193 – GRB7 NUTS A194 GR2H Cadmum Plated
	Bonnet Gasket	Manufacturer's standard
	Seals	Viton
	Slip Material	
	Stem Material	
	Design Conditions	
	Pressure	ANSI B16.5 rating Class 150. Pump pressure nominal 10 barg, surge
	Temperature	10°C TO 80°C
	General Conditions	
	Thermal Relief	1. Valve shall be fitted with integral cavity thermal relief, lockable
	Hydrotest	2. Procedure and results of hydrotesting shall be in accordance with
	NDE	3. NDE of castings shall be to MSS SP55 with 10% selected at random
	Corrosion Allowance	4. All valve bodies shall have a minimum of 1.5mm corrosion
	Painting	5 Painting: manufacturer's standard and if manufacturer's standard is
	Service	Aviation Type Kerosene Jet A-1
	Test	
	Hydrostatic	Body: 30 barg Seal: 22 barg Air Seat/Body: 7 barg
	Impact	As standard
	Certification	Pressure containing parts to DIN 50049.3.1B, non-pressure containing
	Material Requirements	Carbon content is limited to 0.25% max (ladle analysis) with carbon
	Documentation	All Operating, Maintenance, Test, Certification documents to be
	Actuator :Rotork / Equivalent (when the valve is converted from manual to motor actuation then this clause applies)	Model Motor Protection Gearing Hand Operation Drive Bushing Torque and Turns limitation Remote Valve position/Actuator status indication Local Position Indication Integral started & Transformer Integral push buttons and selector Control Facilities Monitoring Facilities Wiring and Terminals Enclosure Start-up Kit Test Certificate

400) SHORT LEAD TIME ITEMS - Package 4: Gaskets and Fasteners				
Sr.	**Description**	**Unit**	**Quantity**	**Clarifications / Notes**
401	Stud bolts, nuts and washers - stud bolts 7/8" x 115mm long (for DN250 150# RF flanges - 1 set = sufficient items for 1 No. flanged joint)	Set	4	Two set in VC-N1 and one in Tie-in VC. Plus 1 Spare. Length of the stud to be determined by contractor with due consideration to the Insulation gasket's thickness
402	Stud bolts, nuts and washers - stud bolts 3/4" x 120mm long (for DN150 300# RF flanges - 1 set = sufficient items for 1 No. flanged	Set	15	14 +1 spare. To blind all the risers during T & C
403	Gaskets spiral wound DN250 (10 inch NPS) compliant with ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with Aviation Fuel Jet A-1 - any asbestos content not permitted. 150# rating	Nos	4	Two set in VC-N1 and one in Tie-in VC. Plus 1 Spare. Length of the stud to be determined by contractor with due consideration to the Insulation gasket's thickness
404	Gaskets spiral wound DN150 (6 inch NPS) compliant with ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with Aviation Fuel Jet A-1 - any asbestos content not permitted. 150# rating	Nos	15	
405	Insulation Gasket Kit DN250 (10 inch NPS) compatible with ASME B16.5 flanges and compatible with Aviation Fuel Jet A-1 - any asbestos content not permitted. Neoprene raced phenolic with phenolic sleeve, phenolic washer and plated steel washers, Type 'F' for raised face flange, Dimension as per ASME B16.20 Std Thk-3mm. 150# rating	Nos	4	

500) LONG LEAD TIME ITEMS Package 5: Aviation Equipment				
Sr.	**Description**	**Unit**	**Quantity**	**Clarifications / Notes**
501	Pit box for Hydrant Pit Valve, Low Point Drain and High Point Vent - "Environmentally Friendly" type in two-piece construction to provide a large ground movement (vertical ± 35 mm, horizontal ± 25 mm) with DN450 (18 inch) dia operational lid opening and positive seal + provision for DN600 (24 inch) opening for maintenance of pit components. Pit cover/lid to be positively restrained from detachment (e.g. by bayonet closure, stout tether) against jet blast effects per JIG requirements and orientation of opening to be flat against apron surface.	Nos	13	Considering that none of the existing pit boxes can be reused
502	Low Point Drain assembly consisting of Ball Valve DN40 (1½ inch NPS) - 2 Nos assembled back-to-back full bore Carbon steel body and stem and SS ball, flanged ASTM B16.5 raised face. Valve construction: ANSI B16.34 pressure and leak tested API 598 Fire Safe design to API 607. Stainless Steel tank unit DN40 (1½ inch NPS) with bleed valve and dust cap. Provision for venting of low point DN150 (6 inch NPS) riser to be made, but small bore screwed plug is not sufficient due to risk of leakage.	Nos	1	
503	Hydrant Pit Valve 4" x 4" Class 150 API 1584 latest edition valve equipped with dual-pilot (lanyard and air-operated pilot valve). Stainless steel API pattern 4 inch adapter with female dust cover and tether per API 1584. Emergency valve (Under Hydrant Valve) 6" x 4" (6" side to mate with DN150/6 inch NPS RF flange on hydrant pit riser). All fasteners (bolts, nuts, washers) to connect Emergency Valve to Hydrant Pit Valve to be supplied by vendor as part of this line item.	Nos	6	Considering that 6 of the existing can be reused and 6 new to be procured. If the existing 6 cannot be reused then contractor to provide them, contractor to account for.
504	Valve Chamber access cover and ladder	Nos	1	

600) NON-LONG LEAD TIME ITEMS - CONTRACTOR SUPPLY (Package 6: Linepipe and Fittings for Test Purposes, Coating Repair)				
Sr. No.	**Description**	**Unit**	**Quantity**	**Clarifications / Notes**
601	Linepipe DN50 (2 inch NPS) Carbon steel API 5L Grade B SMLS 5.54 mm WT (Sch 80).	m	12	Gate valves, DN50 linepipe, WN and BF flanges for stubs to facilitate venting of risers during pressure test and assumed that testing done in loops whilst largest loop is accounted. Can be re-used for future expansion subsequently.
602	Blind flange DN150 (6 inch NPS) forged Carbon steel ASTM A105N (normalised) 300# Raised Face	Nos	15	DN150 Blind Flanges for closure of risers; gate valves and DN50 linepipe and WN flanges for stubs to facilitate venting of risers during pressure test and assumed that testing done in loops whilst largest loop is accounted. Can be re-used for future expansion subsequently. Can be re-used for future expansion subsequently.
603	Gate Valve DN50 (2 inch NPS) forged. Body ASTM A105, stem ASTM A182 Gr. F6a, wedge 13% Cr steel SS304 spiral wound gasket, socket weld ends to ANSI B16.11, design to API 602, pressure and leak test to API 598, fire safe design. Flanged 150# RF	Nos	20	
604	Weld neck flange DN50 (2 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	Nos	20	
605	Blind flange DN50 (2 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	Nos	20	
606	Stud bolts, nuts and washers - stud bolts 5/8" x 85mm long (for DN50 150# RF flanges - 1 set = sufficient items for 1 No. flanged joint)	Set	20	
607	Heat shrink sleeves for field weld joints - HTLP60 20x100/1 - 1.5 6" - 24" pipeline (Raychem or equivalent)	Nos	Per weld Joint	Contractor to determine Quantity Offtake
608	Closure/repair patch WPCP IV 4x17 for 6" - 24" pipeline (Raychem or equivalent)	Nos		Contractor to determine Quantity Offtake
609	Tools and tackles for applying heat shrink sleeves (PERP filler, stanley knives, epoxy bulk kits and any other tools and tackles)	Set	1	Contractor to determine Quantity Offtake
610	Link Seals for valve chamber wall penetrations by DN500 linepipe	Set	6	Contractor to determine Quantity Offtake. It is assumed as 1 new chamber with 4 link seals (i.e. 2 on each wall entry: One in Internal & One in external) and 2 more link seal in existing VC
611	Cable transits for sealing cable penetrations through valve chamber walls (if any required)	Set	To be Confirmed	
612	Emergency Shutdown pushbutton stations, cabling, cable ducting (whether or not strapped to parent hydrant line) etc.	Nos	3	One ESD pushbutton station per bay minimum - to be located such that fuelling operators are not more than 60 m distant when at dispenser panel. 06 stands - Exiting 03 to be reused and New 03 stands to be provided by Contractor.
613	Gaskets spiral wound DN50 (2 inch NPS) compliant with ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with Aviation Fuel Jet A-1 - any asbestos content not permitted	Nos	40	
614	Puddle Flange / Anchor flange for valve chamber wall penetrations by DN250 linepipe	Set	3	Contractor to determine Quantity Offtake. It is assumed as 7 chambers and 1 anchor flange on each wall entry

PRICE BID - CARGO EXPANSION WORKS					
S No.	**DESCRIPTION**	**QTY**	**UNIT**	**RATE (Rs)**	**AMOUNT (Rs)**
A	**Engineering Works**				
1	Preparation and submission of "Fit for Construction "drawings, based on the design supplied by DAFFPL. Preparation and submission of As-Built" drawings, Operation and Maintenance manuals, HAZOP Report, HAZID Report, catalogues, Test certificates etc.	1	Lot		
	Sub Total A				
	In Words:				
B	**Civil Works:**				
2	**Barricade Screen:** Design, supply, providing and removal of Barricade screen with structural supports including necessary foundation & GI sheet upto a height of **3 meter** from the ground level including supply of all materials, labour, columns, pipes, purlins, clamps.....etc. After total completion of the job, the screen to be dismantled and taken away by the contractor. The design to be approved by DAFFPL/DIAL. The screen shall be in position, stable and strong at all times from the commencement to completion of work in all respects.	1500	Sq Mtr		
3	**Excavation,** geotechnical investigation, site survey & sub-base preparation (average depth 2 - 2.5 m) for Hydrant pipe laying works and also for electrical duct bank excavation works as required for ESD and Cathodic Protection Systems.	1563	m^3		
4	**Excavation** & sub-base preparation (average depth 2.5 m) for Hydrant pipe modification works for **realigned existing 03 nos cargo stands**.	1750	m^3		
5	**Supply and Laying of:** 100mm Bottom PCC for receiving sand cushion.	103	m^3		
6	**Supply and Installation: Sand** filling in 300 mm layers up to 300 mm above top of pipe. (refer to standard detail drawings) to set levels in readiness for CLSM. (Proctor density of min. 98% to be achieved all sand filling and compaction works).	2525	m^3		
7	**Supply and filling of:** Reminder of the pipeline trench to be filled with CLSM concrete from the top of sand fill (refer to standard detail drawings) to set levels in readiness for PQ by others.	1325	m^3		
8	**RCC M 45 grade:** Providing and laying in position reinforced cement concrete of M-45 grade with 20mm and down size graded crushed stone aggregate in sub structure of all types including providing pockets, openings etc., where ever required, vibrating, tamping, curing and rendering if reqd. to give a smooth and even surface etc., all complete including cost of shuttering, cost of reinforcement....etc for all depths below and upto plinth level in any shape, position, thickness etc., all complete as specified and directed.	15	m^3		

9	**Valve Chambers:** Construct of valve chamber. Size: 2 meter x 1.5 meter x 3.0 meter deep, Excavation, providing shoring protection, PCC works, construction of valve chambers, including reinforced steel works, concreting works, plastering works, water proofing works…..etc.	1	Nos		
	Installation of suitable size DABICO covers, ladder and chain assembly, sump grating, water proofing...etc is included in contractor scope.				
	Refer drawing # P1101A-M-103 for more details.				
10	**Valve Chambers:** Modifications to the existing valve chamber, works include breaking some portion (access for 10" Pipeline) of the side wall for creating provision to extend the existing 10" Pipeline and making good the surfaces with necessary civil works against ingress of rain water.	1	Lot		
11	**Structural Steel:** Supplying Structural steel IS 2062 Angles, Channels of any sizes as required as per IS, handling, straightening, fabrication, erecting, assembling, fixing and welding all the steel structures in MS Angles/ Channels/ beams/ Gratings/ Chequred Plates and other members, for Pipe supports, Valve Operating Platforms, handrails, platform ladder.... etc., as per site conditions and proposed drawing to be submitted for DAFFPL/DIAL approval. The cost painting also to be included in the quoted price.	2	Ton		
12	**Breaking** of Apron PQC panels of 5 meter x 5 meter each, 400 to 600 mm thick, including the filled up materials below the PQC panels like, and carting away the debris.	350	m^3		
13	**Electrical Duct Bank:** Construction of electrical duct bank, complete with all accessories like, PVC conduits, two or four conduit type, Excavation, providing shoring protection, PCC works, including reinforced steel works, M15 concreting works, plastering works, water proofing works, PVC plugs, cable wire in each conduit, penetration sealing of conduit in valve chamber/electrical manhole.....…..etc. Supply and Installation of Electrical manhole covers.....etc.	160	RMtr		
	Sub Total B				
	In Words:				
C	**Mechanical Works:**				
14	**Fabrication, Installation and testing of :** Line pipe DN250 (10 inch NPS) Carbon steel API 5L Grade B LSAW or ERW 9.27 mm WT (Sch STD) mill coated externally with HDPE in compliance with DIN30670 and internally with amine aduct-cured epoxy in compliance with EI 1541 & JIG 2 requirements suitable for Jet A-1. This item Includes a) Cost of transportation from Facility to Apron, Loading and unloading Charges, Handling, Fabrication, Welding, Aligning, Laying Radiography of weld joints and testing of pipes.	250	M		

15	**Supply, Fabrication, Installation and testing of :** Line pipe DN150 (6 inch NPS) Carbon steel API 5L Grade B SMLS 7.11 mm WT (Sch STD) mill coated externally with HDPE in compliance with DIN30670 and internally with amine aduct-cured epoxy in compliance with EI 1541 & JIG 2 requirements suitable for Jet A-1. This item Includes a) Cost of transportation from Facility to Apron, Loading and unloading Charges, Handling, Fabrication, Welding, Aligning, Laying Radiography of weld joints and testing of pipes, protecting the riser pipes with concrete hume pipes during construction activities ....etc.	90	M		
16	**Fabrication, Installation and testing of**: Line pipe DN200 (8 inch NPS) Carbon steel API 5L Grade B SMLS 8.18 mm WT (Sch STD). Internal and External Mill coated Pipeline suitable for Jet A-1 will be free Issue. Pipeline for fabrication of Low Point Drain Sumps.	6	M		
17	**Supply, Fabrication, Installation and testing of**: Line pipe DN50 (2 inch NPS) Carbon Steel API 5L Grade B SMLS 5.54 mm WT (Sch 80) This item Includes a) Cost of bare pipe b) Loading and unloading Charges c) Cost of Handling, Fabrication, Welding, Aligning, Laying, Radiography of weld joints, testing of pipes and External painting works.....etc.	12	M		
18	**Supply, Fabrication, Installation and testing of**: Line pipe DN40 (1½ inch NPS) Stainless steel ASTM A312 TP316L SMLS Sch 40. This item Includes a) Cost of bare pipe b) Loading and unloading Charges c) Cost of Handling, Fabrication, Welding, Aligning, Laying, Radiography of weld joints, testing of pipes and External painting works.....etc.	6	M		
19	**Fabrication, Installation and testing of:** Butt Weld Bend 45 degree DN250 (10 inch NPS) Carbon steel ASTM A234-WPB 3D radius 9.27 mm WT mill coated externally with HDPE to DIN30670 and internally with amine aduct-cured epoxy suitable for Jet A-1.	2	Nos		
20	**Fabrication, Installation and testing of:** Butt Weld Bend 90 degree DN150 (06 inch NPS) Carbon steel ASTM A234-WPB 3D radius 7.11 mm WT mill coated externally with HDPE to DIN30670 and internally with amine aduct-cured epoxy suitable for Jet A-1.	13	Nos		
21	**Fabrication, Installation and testing of:** Butt Weld End Cap DN200 (8 inch NPS) wrought Carbon steel ASTM A234-WPB Extra Strong Sch 80 ANSI B16.9 for fabrication of Low Point drain sumps mill coated externally with HDPE to DIN30670 & internally with amine aduct-cured epoxy suitable for Jet A-1.	1	Nos		

22	**Supply, Fabrication, Installation and testing of:** Weld neck flange DN150 (6 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face. (For Pressure Testing of Pipeline)	12	Nos		
23	**Supply, Fabrication, Installation and testing of:** Weld neck flange DN50 (2 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	20	Nos		
24	**Supply, Fabrication, Installation and testing of:** Weld neck flange DN250 (10 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	2	Nos		
25	**Supply, Fabrication, Installation and testing of:** Blind flange DN250 (10 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	1	Nos		
26	**Supply, Fabrication, Installation and testing of:** Blind flange DN150 (6 inch NPS) forged Carbon steel ASTM A105N (normalised) 300# Raised Face ***(For Pressure Testing of pipeline)***	12	Nos		
27	**Supply, Fabrication, Installation and testing of:** Blind flange DN50 (2 inch NPS) forged Carbon steel ASTM A105N (normalised) 150# Raised Face	20	Nos		
28	**Supply, Fabrication, Installation and testing of:** Weldolet size Run DN250 (10 inch NPS) x Branch DN200 (8 inch NPS) ASTM A234-WPB Sch STD	1	Nos		
29	**Supply, Fabrication, Installation and testing of:** Weldolet size Run DN250 (10 inch NPS) x Branch DN150 (6 inch NPS) ASTM A234-WPB Sch STD	7	Nos		
30	**Supply, Fabrication, Installation and testing of:** Butt Weld Reducer DN 150 to DN50 (6 x 2 inch NPS) forged Carbon steel ASTM A234-WPB 5.54 mm WT. To be mill coated internally with amine aduct-cured epoxy suitable for Jet A-1	6	Nos		
31	**Installation and testing of:** Pit box for Hydrant Pit Valve, Low Point Drain and High Point Vent - "Environmentally Friendly" type in two-piece construction to provide a large ground movement (vertical ± 35 mm, horizontal ± 25 mm) with DN450 (18 inch) dia operational lid opening and positive seal + provision for DN600 (24 inch) opening for maintenance of pit components.	13	Nos		
32	**Installation and testing of:** Low Point Drain assembly consisting of Ball Valve DN40 (1½ inch NPS) - 2 Nos assembled back-to-back full bore Carbon steel body and stem and SS ball, flanged ASTM B16.5 raised face. Valve construction: ANSI B16.34 pressure and leak tested API 598 Fire Safe design to API 607. Stainless Steel tank unit DN40 (1½ inch NPS) with bleed valve and dust cap. Provision for venting of low point DN150 (6 inch NPS) riser to be made, but small bore screwed plug is not sufficient due to risk of leakage.	1	Nos		

33	**Installation and testing of:** Hydrant Pit Valve 4" x 4" Class 150 API 1584 latest edition valve equipped with dual-pilot (lanyard and air-operated pilot valve). Stainless steel API pattern 4 inch adapter with female dust cover and tether per API 1584. Emergency valve (Under Hydrant Valve) 6" x 4" (6" side to mate with DN150/6 inch NPS RF flange on hydrant pit riser). All fasteners (bolts, nuts, washers) to connect Emergency Valve to Hydrant Pit Valve will be supplied by supplier.	12	Nos		
34	**Supply & Installation of:** Insulation gasket kit flange DN 250 (10 Inch NPS) compatible with Aviation Fuel Jet A-1 - any asbestos content not permitted. Neoprene raced plenolic with phenolic sleeve, phenolic washer and plated steel washers, type "F" for raised face flange, dimensions as per ASME B16.20 Std Thk- 3mm. 150# rating.	6	Nos		
35	**Installation of:** Isolation kit flange assembly for the Hydrant Pit Valve 6" x 4" Class 150 API 1584 latest edition valve equipped with dual-pilot (lanyard and air-operated pilot valve). (Kit consists of insulation sleeves, insulation washers and insulation gasket).	6	Nos		
36	**Supply, Installation and testing of:** Double Block and Bleed Valve DN250 (10 inch NPS) ASTM 216 Gr WCB6 rising stem outside screw and yoke to API 600 ASME B16.5 flanged 150# raised face, **gearbox operated with handwheel**. Over-riding requirement is that all wetted parts must be compatible with Aviation Fuel Jet A-1 and vendor to ensure and warrant the same. . Refer MTO for further details. **Make: Control Seals(Netherlands) or Cameroon (USA) or L&T (India) or Ghatge Patil (India).**	1	Nos		
37	**Supply, Fabrication, Installation and testing of :** Gate Valve DN50 (2 inch NPS) forged. Body ASTM A105, stem ASTM A182 Gr F6a, wedge 13% Cr steel SS 304 spiral wound gasket, socket weld ends to ANSI B16.11, design to API 602, pressure and leak test to API 598. fire safe design. Flanged 150# RF.	20	Nos		
38	**Supply, Installation and testing of:** Pipe penetration seals (modular sleeve elements for valve chamber sealing) - "Link Seal" of GPT Industries or similar for DN250 (10 inch NPS) pipe. **Make: GPT make or Cavotec make or Avery Hardol or Carter.**	6	Sets		
39	**Installation and Testing of:** Vault access covers with complete assembly, Comprising:- Vault Access Cover Assembly with Waterproof aircraft load-rated (upto 900 kN), one hand lift torsion-actuated cast aluminium cover assembly (max. lift weight <12KG) w/ integral lock and security tool, and pit form 600mm deep with 12mm thick pit walls, an aluminium flange, and integral concrete anchors/ reinforcement ribs, including: - Hinged grating platform, One-Rung Ladder Extension Handrail Assembly: stainless steel, to provide easier entry/exit from underground chambers, valve vaults, or pits.				

	-Safety Post & Chain Assembly: to prevent accidental entry into chambers, valve vaults, or pits when cover is open, including stainless steel stanchion posts, stainless steel safety chains, and quick links. powder coated orange. ▪Ladder Assembly, Fabricated ladder assembly, stainless steel, for connection to one-rung ladder and extension handrail assembly c/w telescopic feet and wall mounts, ladder dimensions to ANSI 14.3, Sections 4.2.1.1, 5.1.1, 5.1.2, and 5.3.2.2, for installation in vault with overall depth of 3000mm.				
	Vault Access cover - 1040mm x 1900mm (Ladder, Safety post & chain assembly Included) (Model DAB:741 of Cavotec make or Avery Hardoll or Carter or Elkinton Gatic)	1	nos		
40	**Supply, Fabrication, Installation and testing of:** Stud bolts, nuts and washers - stud bolts 7/8" x 115mm long (for DN250 150# RF flanges)**. Length of the stud to be determined by contractor with due consideration to the Insulation gaskets thickness.**	4	Sets		
41	**Supply, Fabrication, Installation and testing of:** Stud bolts, nuts and washers - stud bolts 3/4" x 120mm long (for DN150 300# RF flanges)**. For blind all the risers during T&C**	15	Sets		
42	**Supply, Fabrication, Installation and testing of:** Stud bolts, nuts and washers - stud bolts 5/8" x 85 mm long (for DN50, 150# RF flanges)**.**	20	Sets		
43	**Supply, Fabrication, Installation and testing of:** Gaskets spiral wound DN250 (10 Inch NPS) compliant witj ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with ATF - any asbestos content not permitted. 150# rating	4	Nos		
44	**Supply, Fabrication, Installation and testing of:** Gaskets spiral wound DN150 (6 Inch NPS) compliant witj ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with ATF - any asbestos content not permitted. 150# rating	15	Nos		
45	**Supply, Fabrication, Installation and testing of:** Gaskets spiral wound DN50 (2 Inch NPS) compliant with ASME B31.4 / ASME B16.20 / ASME B16.21 and compatible with ATF - any asbestos content not permitted. 150# rating	6	Nos		
46	**Supply, Fabrication, Installation and testing of:** Pipeline Isolation Flange Kits DN250 (10 inch NPS)	4	Nos		
47	**Supply, Fabrication, Installation and testing of:** Heat shrink sleeves for field weld joints - HTLP60 20x100/1 - 1.5 6" - 10" pipeline (Raychem or equivalent)	25	Sets		
48	**Supply, Fabrication, Installation and testing of:** Closure patch WPCP IV 4x17 for 6" - 10" pipeline (Raychem or equivalent)	25	Sets		
49	**Supply of:** Tools and tackles for applying heat shrink sleeves (PERP filler, stanley knives, epoxy bulk kits and any other tools and tackles). Repair patch for damaged PE coating, Applicator pad kit for heat shrink sleeve, Silicon roller for heat shrink sleeve, Filler for repair patch...etc.	1	Lot		

50	Supply & Fixing of Cable transits for sealing cable penetrations through valve chamber walls (if required)	1	Nos		
51	Supply & Installation of Puddle Flange / Anchor Flange for Valve chamber wall penetrations by DN250 Linepipe.	3	Sets		
	Sub Total C				
	In Words:				
D	**Cathodic Protection Works:**				
52	**Design, Supply, Fabrication, Installation and testing of:** Cathodic protection system for the hydrant pipeline project, including soil resistivity test, provision of sacrificial anode beds, rectifier transformer, continuity straps and lightning surge protectors, test stations, cad welding of jumpers, junction boxes with associated wiring, integration with existing pipeline cathodic protection system, testing and commissioning....etc	1	Lot		
	Sub Total D				
	In Words:				
E	**Pre-Commissioning & Commissioning**				
53	Providing skilled / semi-skilled / labour manpower assistance for Pre-Commissioning and Commissioning works.				
54	Skilled Manpower	30	Man days		
55	Semi-skilled Manpower	30	Man days		
56	Labourer	30	Man days		
	Sub Total E				
	GRAND Total(A+B+C+D+E)				
GRAND TOTAL In Words:					