



INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

GT ROAD, KALYANPUR, KANPUR - 208016

UTTAR PRADESH, INDIA

TENDER REFERENCE NO.: IITK/AE/AK/UAY/2021/05

BID SUBMISSION END DATE- 22.04.2021

TENDER DOCUMENTS

For

“Purchase of Combustor Test Rig”

BID DOCUMENT

The Indian Institute of Technology Kanpur (“the IITK”) invites Bids (“Bids”) from eligible, qualified and capable companies for the supply and delivery of “the Goods” and provision of associated services (“Associated Services”) according to the requirements as defined in the Tender document.

Name of Work	Purchase of Combustor Test Rig
Date of Publishing	01.04.2021 (04.00 PM)
Clarification Start Date and Time	01.04.2021 (04.00 PM)
Clarification End Date and Time	22.04.2021 (04.00 PM)
Queries (if any)	No queries will be entertained after clarification end date and time
Bid Submission Start Date	01.04.2021 (04.00 PM)
Last Date and time of uploading of Bids	22.04.2021 (04.00 PM)
Last Date and time of submitting , EMD and other documents at IIT Kanpur (if any)	-NA-
Date and time of opening of Technical Bids	23.04.2021 (04:00 PM)
Date and time of opening of Financial Bids	Will be separately notified for Technically shortlisted/qualified bidders

Interested parties may view and download the tender document containing the detailed terms & conditions from the website <http://eprocure.gov.in/eprocure/app>

(The bids must be submitted online in electronic form on www.eprocure.gov.in only. No physical bids will be accepted.)

(A)
INSTRUCTION FOR ONLINE BID SUBMISSION

The bidders are required to submit soft copies of their bids electronically on the Central Public Procurement (CPP) Portal ie <http://eprocure.gov.in/eprocure/app> , using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

1. REGISTRATION

- (i) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL:<https://eprocure.gov.in/eprocure/app>) by clicking on the link “Online Bidder Enrolment” option available on the home page. **Enrolment on the CPP Portal is free of charge.**
- (ii) During enrolment/ registration, the bidders should provide the correct/ true information including valid email-id & mobile no. All the correspondence shall be made directly with the contractors/ bidders through email-id provided.
- (iii) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
- (iv) For e-tendering possession of valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) is mandatory which can be obtained from SIFY /nCode/eMudra or any Certifying Authority recognized by CCA India on eToken/ SmartCard.
- (v) Upon enrolment on CPP Portal for e-tendering, the bidders shall register their valid Digital Signature Certificate with their profile.
- (vi) Only one valid DSC should be registered by a bidder. Bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse and should ensure safety of the same.
- (vii) Bidders can then log into the site through the secured login by entering their userID/ password and the password of the DSC/ eToken.

2. SEARCHING FOR TENDER DOCUMENTS

- (i) There are various search options built in the CPP Portal to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords, etc., to search for a tender published on the CPP Portal.
- (ii) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective ‘My Tenders’ folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.
- (iii) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

3. PREPARATION OF BIDS:

- (i) For preparation of bid Bidders shall search the tender from published tender list available on

site and download the complete tender document and should take into account corrigendum if any published before submitting their bids.

After selecting the tender document same shall be moved to the 'My favourite' folder of bidders account from where bidder can view all the details of the tender document.

- (ii) Bidder shall go through the tender document carefully to understand the documents required to be submitted as part of the bid. Bidders shall note the number of covers in which the bid documents have to be submitted, the number of documents – including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- (iii) Any pre-bid clarifications if required, then same may be obtained online through the tender site, or through the contact details given in the tender document.
- (iv) Bidders should get ready in advance the bid documents in the required format (PDF/xls/rar/dwf/jpg formats) to be submitted as indicated in the tender document/schedule. **Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.**
- (v) Bidders can update well in advance, the documents such as experience certificates, annual report, PAN, EPF & other details etc., under "My Space/ Other Important Document" option, which can be submitted as per tender requirements. This will facilitate the bid submission process faster by reducing upload time of bids.

4. SUBMISSION OF BIDS:

- (i) Bidder should log into the site well in advance for bid submission so that he/ she upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay.
- (ii) Bidder should prepare the EMD as per the instructions specified in the NIT/ tender document. The details of the DD/BC/BG/ others physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.
- (iii) While submitting the bids online, the bidder shall read the terms & conditions (of CPP portal) and accepts the same to proceed further to submit their bid.
- (iv) Bidders shall select the payment option as offline to pay the EMD and enter details of the DD/BC/BG/others.
- (v) Bidder shall digitally sign and upload the required bid documents one by one as indicated in the tender document.
- (vi) Bidders shall note that the very act of using DSC for downloading the tender document and uploading their offers is deemed to be a confirmation that they have read all sections and pages of the tender document without any exception and have understood the complete tender document and are clear about the requirements of the tender document.
- (vii) Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document. For the file size of less than 1 MB, the transaction uploading time will be very fast.
- (viii) **If price quotes are required in XLS format, utmost care shall be taken for uploading Schedule of quantities & Prices and any change/ modification of the price schedule shall render it unfit for bidding.**

Bidders shall download the Schedule of Quantities & Prices i.e. Schedule-A, in XLS format and save it without changing the name of the file. Bidder shall quote their rate in figures in

the appropriate cells, thereafter, save and upload the file in financial bid cover (Price bid) only.

If the template of Schedule of Quantities & Prices file is found to be modified/corrupted in the eventuality by the bidder, the bid will be rejected and further dealt as per provision of clause no 23.0 of ITB including forfeiture of EMD.

The bidders are cautioned that uploading of financial bid elsewhere i.e. other than in cover 2 will result in rejection of the tender.

- (ix) Bidders shall submit their bids through online e-tendering system to the Tender Inviting Authority (TIA) well before the bid submission end date & time (as per Server System Clock). **The TIA will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders at the eleventh hour.**
- (x) After the bid submission (i.e. after Clicking “Freeze Bid Submission” in the portal), the bidders shall **take print out of system generated acknowledgement** number and keep it as a record of evidence for online submission of bid, which will also act as an entry pass to participate in the bid opening.
- (xi) Bidders should follow the server time being displayed on bidder’s dashboard at the top of the tender site, which shall be considered valid for all actions of requesting, bid submission, bid opening etc., in the e-tender system.
- (xii) All the documents being submitted by the bidders would be encrypted using PKI (Public Key Infrastructure) encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology.
- (xiii) Bidder will get all benefits under Rule 153 GFR-2017.

5. ASSISTANCE TO BIDDERS:

- (i) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender. The contact number of end user is 0512-259-7126. Please call between 10:30 hrs to 17:00 hrs .
- (ii) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24X7 CPP Portal Helpdesk. The 24 x 7 Help Desk Number 0120-4200462, 0120-4001002 and 0120-4001005. The helpdesk email id is support-eproc@nic.in

(B)
INSTRUCTION FOR e-PROCUREMENT

1. PREPARATION AND SUBMISSION OF BIDS:

- a. The detailed tender documents may be downloaded from <http://eprocure.gov.in/eprocure/app> till the last date of submission of tender. The Tender may be submitted online through CPP Portal <http://eprocure.gov.in/eprocure/app>
- b. The bidder should submit the bid online in two parts viz. Technical Bid and Financial Bid. Technical Bid should be upload online in cover 1 and Financial Bid in “.Xls” should be upload online in cover-2

2. SUBMISSION OF THE BID :

All interested eligible bidders are requested to submit their bids online on CPP Portal: <http://eprocure.gov.in/eprocure/app> per the criteria given in this document:

- a. Technical Bid should be upload online in cover-1.
- b. Financial Bid should be upload online in cover-2

Both Technical and Financial Bid covers should be placed online on the CPP Portal (<http://eprocure.gov.in/eprocure/app>).

3. TECHNICAL BID:

Signed and Scanned copies of the Technical bid documents as under must be submitted online on CPP Portal: <http://eprocure.gov.in/eprocure/app> .

- a. **List of Documents to be scanned and uploaded (Under Cover-1) within the period of bid submission:-**
 - i. Scanned copy of Bank details.
 - ii. Scanned copy of work experience.
 - iii. Scanned copy of certificate of GST.
 - iv. Scanned copy of specifications/brochures & tender acceptance letter on Appendix 1-3.
 - v. Scanned copy of another document mentioned in tender document (if any)
 - vi. Declaration for local content, Country of Origin of goods and Bid Security on Appendix 4-5.
 1. For The tender value upto Rs. 10 Crores - Self-Certificate for local content from the bidder.
 2. For the tender value above Rs. 10 Crores - Certificate for local content from Statutory Auditor/Cost Auditor/Cost Accountant/CA.
- b. **For Import Shipments – Shipping Terms Ex-Works/FOB are preferred.**

NOTE - no indication of the rates/amounts be made in any of the documents submitted with the TC-BID.

4. FINANCIAL BID

- a. The currency of all quoted rates shall be Indian Rupees. All payment shall be made in Indian Rupees.
- b. In preparing the financial bids, bidders are expected to take into account the requirements and conditions laid down in this Tender document. The financial bids should be uploaded online as per the specified “.Xls” format i.e. Price Bid Excel sheet attached as ‘.Xls’ with the tender and based on the scope of work, service conditions and other terms of the Tender

document. It should include all costs associated with the Terms of Reference/Scope of Work of the assignment.

- c. The Financial Proposal should be inclusive of all applicable taxes, duties, fees, levies, and other charges imposed under the applicable laws. The rates quoted in the Tender are inclusive of all applicable taxes, duties etc. **except service tax**. The service tax component shall be re-immersible by the department after receipt of paid challans etc. if applicable.

5. LAST DATE FOR SUBMISSION OF TENDER:

- a. Online bids complete in all respects, must be submitted on or before the last date and time specified in the schedule of events.
- b. The IIT, Kanpur may, at its own discretion, alter/extend the last date for submission of tenders.

6. BID VALIDITY

- a. All the Bids must be valid for a period of 90 days from the last date of submission of the tender for execution of Contract. However, the quoted rates should be valid for the initial/extended period of the Contract from the effective date of the Contract. No request will be considered for price revision during the original Contract period.
- b. A bid valid for a shorter period shall be declared as non-responsive.
- c. In exceptional circumstances, prior to expiry of the original time limit, the IIT may request the bidders to extend the period of validity for a specified additional period beyond the original validity of 90 days. The request and the bidders' responses shall be made in writing. The bidders, not agreeing for such extensions will be allowed to withdraw their bids without forfeiture of their Bid Security.

7. MODIFICATION / SUBSTITUTION/ WITHDRAWAL OF BIDS:

- a. No Bid shall be modified, substituted or withdrawn by the Bidder after the Bid's due Date.
- b. Any alteration/ modification in the Bid or additional information supplied subsequent to the Bid's due Date, unless the same has been expressly sought for by the Authority, shall be disregarded.

8. REJECTION OF THE BID:

The bid submitted shall become invalid and tender fee shall not be refunded if:-

- a. The bidder is found ineligible.
- b. The bidder does not upload all the documents as stipulated in the bid document.

9. SELECTION CRITERIA:

Phase-I: Technical Evaluation & Sample Approval

Technical evaluation will be done on the basis of information given by technical bid submitted by the bidders. Bid containing partial, incomplete, uncleared and superfluous and unwanted information will be summarily rejected.

Technical declaration must be supported with relevant document. Discrepancy in relevant supporting document and technical compliance sheet shall lead to rejection of technical bids.

Sample Approval:

Bidders should have to display their samples (if asked) on DD.MM.YYYY at the Central Store & Purchase Section of IIT Kanpur. Non-display of sample shall be considered as non-responsive technical bids.

Phase-II

- a. Financial bids of technically qualified and approve samples bidders shall be opened.
- b. Financial evaluation is purely done on the total financial implication.
- c. Any superfluous, unreasonable assets rate quotes will be summarily rejected.

10. Late Delivery:

Delivery must be completed within the period mentioned in tender document from the date of receipt of the order. Penalty @ 1% per week or part thereof subject to a maximum of 10% of the delivery price will be deducted from the balance payment if supply is not completed within stipulated period.

11. Instruction to the bidder of countries which share land border with India (Rule 144(xi) GFRs)

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Department for Promotion of Industry and Internal Trade (DPIIT).
- II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.
- III. "Bidder from a country which shares a land border with India" for the purpose of this Order means: -
 - a. An entity incorporated, established, or registered in such a country; or
 - b. A subsidiary of an entity incorporated, established, or registered in such a country; or
 - c. An entity substantially controlled through entities incorporated, established, or registered in such a country; or
 - d. An entity whose beneficial owner is situated in such a country; or
 - e. An Indian (or other) agent of such an entity; or
 - f. A natural person who is a citizen of such a country; or
 - g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The beneficial owner for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership , the beneficial owner is the natural person(s), who , whether acting alone or together , or through one or more juridical person, has a controlling ownership interest or who exercises control through other means .

Explanation-

- a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company.
- b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements.
2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;
3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who , whether acting alone or together , or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals ;
4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official.
5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee , the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership .

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.

VI. In case of tenders for Works contracts, including Turnkey contracts, The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority .

12. As per the Ministry of Commerce and Industry Order No. P-45021/2/2017-PP(BE-II) dated 04.06.2020 preference shall be given to Make in India products for which it is mandatory for bidders to declare Country of Origin of goods and percentage of Local contents in the product.

Definitions:

“Local Content” means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

“Class-I local supplier” means a supplier or service provider, whose goods, services or works offered for procurement, has local content to or more than 50%, as defined under this order.

“Class-II local supplier” means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%, as defined under this order.

“Margin of purchase preference” means the maximum extent to which the price quoted by a Class-I local supplier may be above the L1 for the purpose of purchase preference. (shall be 20%)

Purchase Preference:

- (a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.
- (b) In the procurements of goods or works, which are covered by para 3(b) above and which are divisible in nature, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
 - i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.
 - ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the 'Class-I local supplier's' quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on 'Class-I local suppliers', then such balance quantity may also be ordered on the L1 bidder.
- (c) In the procurements of goods or works, which are covered by para 3(b) above and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
 - i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.
 - ii. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to 'Class-I local supplier's' quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.
 - iii. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.
- (d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

(C)
COMMERCIAL TERMS AND CONDITIONS

1. DEFINITIONS

These Commercial Terms and Conditions shall constitute the General Conditions of Contract, where no separate contract is signed with the selected Bidder(s), and, the Bidders by putting their signature and stamp on each page of this Section V are binding themselves to these Terms and Conditions. In the Commercial Terms and Conditions as defined below, words and expressions shall have the following meanings assigned to them:

- a. "Contract" means the agreement of the Parties relating to the procurement of Goods and / or the IITK Purchase Order (PO), and all attachments incorporated by reference, which shall form an integral part of the Contract. In the event of any discrepancy, the documents to prevail shall be given precedence in the following order: (i) the Contract (where separately signed), (ii) the IITK Purchase Order, (iii) its attachments, and (iv) these Commercial Terms and Conditions;
- b. "Contractor" means the person or entity named in the 'CONTRACTOR' named field of the IITK Purchase Order and any agreed in writing by the IITK legal successor(s) in title;
- c. "Day" means any calendar day;
- d. "Delivery Date" means the latest possible date by which the Goods shall be delivered by the Contractor to the IITK, as specified in the 'DELIVERY DATE' named field of the IITK Purchase Order;
- e. "Force Majeure" shall mean any unforeseeable exceptional situation or event beyond the Parties' control which prevents either of them from fulfilling any of their obligations under the Contract, was not attributable to error or negligence on their part (or of their partners, contractors, agents or employees), and could not have been avoided by the exercise of due diligence. Defects in equipment or material or delays in making them available, labour disputes, strikes or financial problems cannot be invoked as Force Majeure by the defaulting Party. Neither of the Parties shall be held liable for breach of its obligations under the Contract if it is prevented from fulfilling them by Force Majeure. The Party invoking Force Majeure shall notify the other without delay, stating the nature, likely duration and foreseeable effect, and take any measure to minimize possible damage;
- f. "Goods" means all of the goods to be supplied to the IITK by the Contractor under the Contract;
- g. "IITK" means the Indian Institute of Technology Kanpur;
- h. "IITK Purchase Order" means the IITK's official Purchase Order document;
(i) "Party" means the IITK or the Contractor and "Parties" means the IITK and the Contractor; and
(ii) "Place(s) of Delivery" means the location(s) or place(s) where the Goods are to be delivered, as specified in the 'SHIP TO' named field of the IITK Purchase Order.

2. CONCLUSION OF THE CONTRACT

- 2.1. The Contract is made between the IITK and the Contractor. The Contractor is engaged as an independent contractor for the sole purpose of delivering the Goods.
- 2.2. The Contract shall be concluded upon the Contractor duly following the countersigning

procedure as stated in the IITK Letter of Intent (LOI).

3. FUNDING

This Contract shall become and remain effective only on the condition that an official Purchase Order is issued by IITK following the conclusion of tender exercise. In the event this is not or no longer shall the case, the IITK without unreasonable delay notify the Contractor thereof.

Any continuation of the Contractor's performance under this Contract after being notified by the IITK shall be at the Contractor's risk and expense.

4. DELIVERY AND TAKE-OVER OF GOODS

The Contractor shall deliver the Goods at the Place(s) of Delivery. On behalf of the IITK, a duly authorised representative(s), shall take-over the Goods upon delivery. Take-over of the Goods by the IITK shall not be deemed acceptance of the Goods by the IITK. The time of delivery as specified in the Contract / PO shall be strictly adhered to, and time shall be of the essence.

5. QUALITY OF GOODS

5.1. The Contractor shall deliver Goods that are:

- a. of the quality, quantity and description as required by the Contract / PO; and
- b. free from any right or claim of a third party, including rights based on industrial property or other intellectual property.

5.2. Should the Goods be of the type "homogeneously defined" or disposable, the Contractor shall provide a sample and undertake, certify, and guarantee that all Goods delivered shall be of the same quality and characteristics as the sample(s) provided.

6. INSPECTION AND ACCEPTANCE

6.1. The duly authorised representative(s) of the IITK shall have the right, before payment, to inspect the Goods either at the Contractor's stores, during manufacture, at the ports and/or in places of shipment, or at the Place(s) of Delivery. The Contractor shall provide all facilities for such inspection. The IITK may issue a written waiver of inspection. Any inspection carried out by representative(s) of the IITK or any waiver thereof shall be without prejudice to other provisions of the Contract concerning obligations assumed by the Contractor, including specifications of the Goods.

6.2. Upon delivery and inspection of the Goods, the IITK shall inspect the goods as soon as possible and complete the Goods Receiving Document. Should any Goods fail to conform to the technical specifications, codes and standards under the Contract, the IITK may reject the Goods. The Contractor shall, at no cost to the IITK, replace the rejected Goods or, alternatively, rectify the non-conformity.

6.3. In the case of Goods ordered on the basis of specifications or samples, the IITK shall have the right to reject the Goods or any part thereof and terminate the Contract if the Goods do not conform to the specifications and/or samples. Nothing in this clause shall in any way release the Contractor from any warranty or other obligations under the Contract.

7. SHIPPING AND INSURANCE

For overseas orders, shipping arrangements shall be co-ordinated by IITK. Original shipping documents including the packing list shall be airtailed/mailed by the Contractor to the (Assistant Registrar (S&P), IIT, Kanpur – 208 016, UP, India).

8. OBSERVANCE OF LAW AND EXPORT LICENCES

The Contractor shall comply with all laws, ordinance, rules and regulations bearing upon the performance of its obligations under the terms of the Contract. If an export licence or any other governmental authorisation is required for the Goods, it shall be the obligation of the Contractor to obtain such licence or governmental authorisation. In the event of the Contractor's failure to obtain such licence or authorisation within a reasonable time, the IITK may immediately terminate the Contract. Where the award procedure or execution of the Contract is vitiated by substantial errors or irregularities or by fraud, the IITK shall suspend execution of the Contract.

Where such errors, irregularities or fraud are attributable to the Contractor, the IITK may also refuse to make payments or may recover monies already paid, in proportion to the seriousness of the errors, irregularities or fraud. The purpose of suspending the Contract shall be to verify whether presumed substantial errors and irregularities or fraud have actually occurred. If they are not confirmed, execution of the Contract shall resume as soon as possible. A substantial error or irregularity shall be any infringement of a contract or regulatory provision of India, resulting from an act or an omission that causes or might cause a financial loss.

9. PRICE

The price of the Goods shall be as stated in the Purchase Order and may not be increased.

10. PAYMENT

- 10.1.** Unless otherwise stipulated in the Purchase Order, the IITK shall make payment within thirty (30) Days of the later of:
 - a.** Successful delivery of the goods to IITK as confirmed by the consignee (Assistant Registrar, Store & Purchase, IIT-Kanpur), endorsed by the indenter and approved by the indenters' Head of Department / Section;
 - b.** Receipt of customary shipping documents and any other documents specified in the Contract; and (c) Receipt of the original invoice issued by the Contractor.
- 10.2.** All invoices shall be in original and shall contain the IITK Purchase Order number, and a description, the quantities, unit and total price(s) of the Goods delivered. The currency of invoice and payment shall be as specified in the Purchase Order. Unless otherwise authorised by the IITK, a separate invoice shall be submitted for each shipment under the Contract / PO. Subject to Clause 11 below ('Tax Exemption'), if applicable, the GST amount shall be separately identified in the invoice.
- 10.3.** Payments shall be made in the currency stated in the Contract / PO, on the basis of the equivalent value of INR on the day of payment and paid directly into the nominated bank account.
- 10.4.** The IITK shall not pay any charge for late payments.

11. TAX EXEMPTION

The Contractor's price shall reflect any tax exemption to which the IITK is entitled. If it is subsequently determined that any taxes that have been included in the price are not required to be paid or if, having been paid, any such taxes are subject to refunding, the IITK shall deduct the amount from the Contract price. Payment of such adjusted amount shall constitute full payment by the IITK. In the event that any taxing authority refuses to recognize the IITK's exemption from taxes, the Contractor shall immediately consult with the IITK to determine a mutually acceptable procedure for settling the applicable amount.

12. WARRANTY

- 12.1.** The Contractor warrants that the Goods furnished under the Contract conform to the technical specifications, description and standards specified in the Contract, and are new and unused, and free from defects in design, workmanship and/or materials.
- 12.2.** The Contractor shall provide a warranty for the Goods for a period of one year from the date of acceptance of the Goods by the IITK, unless the standard manufacturer's warranty period is longer in which case the longer period shall apply.
- 12.3.** In the case of "homogeneously defined" or disposable goods, should any portion of the Goods, at any time, not comply with clause 5.1 or 5.2 herein or otherwise prove to be defective, the Contractor shall, upon written notification from the IITK, replace that portion of the Goods and bear all costs associated with the replacement of same.

13. PACKING

- 13.1.** The Goods shall be packed and marked in a proper manner and in accordance with the Contract and any statutory requirements and any requirements of the carrier(s). In particular, the Goods shall be marked with the IITK Purchase Order number and the net, gross and tare weights, the name of the contents shall be clearly marked on each container and all containers of hazardous goods (and all documents relating thereto) shall bear prominent and adequate warnings.
- 13.2.** The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination. The packing shall be sufficient to withstand, without limitation, rough handling during transit. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the final destination and the absence of appropriate handling facilities at all points in transit.
- 13.3.** All packaging materials shall be non-returnable.

14. DEFAULT AND DAMAGES

- 14.1.** If due to reasons attributable to the Contractor, the Contractor fails or refuses to:
 - a.** deliver any or all of the Goods under the Purchase Order;
 - b.** comply with any or all of the terms and conditions set out in the Purchase Order; or
 - c.** deliver any or all of the Goods under the Purchase Order on or before the Delivery Date; the IITK may hold the Contractor in default under the Purchase Order.
- 14.2.** When the Contractor is thus in default, the IITK may, by written notice to the Contractor, immediately terminate the Purchase Order in whole or in such part or parts thereof in respect of which the Contractor is in default.
- 14.3.** Alternatively, to clause 14 above when the Contractor is thus in default, the IITK may, at its own discretion, set a reasonable period of time for the Contractor to remedy its default. Any new Delivery Date shall be specified in a written amendment to the Purchase Order, duly countersigned by the Contractor.
- 14.4.** The IITK may, at its discretion, impose penalties upon the Contractor calculated in accordance with clause 15 for each Day the Contractor is late in delivering the Goods past the Delivery Date initially specified in the Purchase Order.
- 14.5.** If the Contractor does not remedy its default within the period of time accorded under clause 16, the IITK may, by written notice to the Contractor, terminate the Purchase Order with immediate effect.
- 14.6.** Upon any termination of the Purchase Order, in whole or such part(s) thereof in respect of which the Contractor is in default, the IITK may engage another contractor to deliver the Goods and recover any difference in price and any additional costs from the Contractor.
- 14.7.** The Contractor shall indemnify the IITK for all losses, charges, costs and expenses, which the IITK may suffer or incur as a result the Contractor's default, including those resulting from engaging another contractor pursuant to this clause 14.

15. PENALTIES

If, in accordance with clause 15, the IITK imposes penalties on the Contractor, such penalties shall amount to One percent (1%) of the total Purchase Order price for each week following the initial Delivery Date specified in the Purchase Order but shall not amount to more than Ten percent (10%) of the total Purchase Order value. The penalties for the delay may be deducted by IITK from any sum(s) due, or to become due, by the IITK to the Contractor.

16. DELAY NOT ATTRIBUTABLE TO THE CONTRACTOR

If the Contractor is delayed at any time in the delivery of the Goods or fulfilment of any other of the Contractor's obligations by any act or omission of the IITK, or by any of its officials, or by any separate contractor(s) contracted by the IITK, or by changes ordered in the type and/or quantity of the ordered Goods, or the Place(s) of Delivery, or any causes beyond the Contractor's reasonable control, or by any other cause, which the IITK determines may reasonably justify the delay, the Delivery Date of the Goods, or fulfilment of any other of the Contractor's applicable obligations shall be extended for such reasonable period of time as the IITK and the Contractor mutually determine. The set reasonable period of time and any amended delivery date shall be specified in a written amendment to the Contract / PO, duly countersigned by the Contractor.

17. FORCE MAJEURE

As soon as possible after the occurrence of any event constituting Force Majeure, but no later than three (3) Days, the Contractor shall give notice and full particulars in writing to the IITK of the Force Majeure. If the Contractor is thereby rendered unable, wholly or in part, to meet its obligations under the Contract, the IITK may terminate the Contract / PO with immediate effect by providing written notice to the Contractor.

18. INDEMNITY

- 18.1.** The Contractor shall indemnify, hold and save harmless and defend at its own expense the IITK, and all of the foregoing's officials, agents, servants and employees from and against all suits, claims, demands and liability of any nature or kind, including costs and expenses, arising out of acts or omissions of the Contractor or its employees, agents or subcontractors in the performance of the Contract.
- 18.2.** Clause 18 shall include, without limitation, claims and liabilities in the nature of workmen's compensation and claims and liabilities arising out of the use of patented inventions or devices.

19. ASSIGNMENT

- 19.1.** The Contractor shall not assign, transfer, pledge or make other disposition of the Purchase Order or any part thereof or of any of the Contractor's rights, claims or obligations under the Purchase Order except with the express written consent of the IITK. Any assignment made without such consent shall be void and of no effect.
- 19.2.** The Contractor shall not subcontract any of its obligations under the Contract / PO without the express written consent of the IITK. The IITK may require the Contractor to furnish particulars of the proposed subcontract as the IITK deems necessary.
- 19.3.** The IITK's approval of any subcontracting shall not relieve the Contractor from any liability or obligation under the Contract. In any subcontract, the Contractor agrees to bind the subcontractor by the same terms and conditions by which the Contractor is bound under the Contract / PO.

20. INSOLVENCY AND BANKRUPTCY

20.1. Should the Contractor become insolvent or should control of the Contractor change by virtue of insolvency, the IITK may with immediate effect and without prejudice to any other right or remedy available to it, suspend the performance of the Contractor's obligations or terminate the Purchase Order with immediate effect, by providing the Contractor with written notice thereof.

20.2. Should the Contractor be adjudged bankrupt, or should the Contractor make a general assignment for the benefit of its creditors, or should a receiver be appointed on account of the Contractor's insolvency, the IITK may, without prejudice to any other right or remedy available to it, terminate the Purchase Order with immediate effect by providing the Contractor with written notice thereof.

21. TERMINATION

21.1. The IITK shall have the right to terminate the Purchase Order or any of the provisions thereof at any time by serving a three days' notice to the Contractor.

22. WAIVER

A waiver of any breach of or default under the Contract / PO shall not constitute a waiver of any other breach or default and shall not affect the other terms of the Contract / PO. The rights and remedies provided by the Purchase Order are cumulative and are not exclusive of any other rights or remedies.

23. ADVERTISING

The Contractor shall not advertise or otherwise make public the fact that it is a contractor to the IITK. The Contractor shall not in any way use the name, emblem, logo, official seal, or any abbreviation of the IITK.

24. DISCRETION AND CONFIDENTIALITY

The Contractor is required to exercise the utmost discretion in all matters relating to the Contract / Purchase Order. Unless required in connection with the performance of the Purchase Order or expressly authorised in writing by the IITK, the Contractor shall not disclose at any time to any third party any information which has not been made public and which is known to the Contractor by reason of its association with the IITK. The Contractor shall not, at any time, use such information to any private advantage. These obligations do not lapse upon any completion, expiration, cancellation or termination of the Contract / PO.

25. NOTICES

Any notice given in connection with the Contract shall be given in English and in writing and shall be deemed to be validly given if sent by registered mail or by fax or by email to the other Party at the following:

- a. for the IITK: the contact details set out in the 'IITK BUYER' name field of the Purchase Order; and
- b. for the Contractor: the contact details set out in the 'CONTRACTOR' named field of the IITK Contract/Purchase Order.

26. STAFF MEMBERS NOT TO BENEFIT

The Contractor shall not grant to any official of the IITK any direct or indirect benefit or preferential treatment on the basis of the Purchase Order or the award thereof. Any breach of this provision shall constitute a fundamental breach of the Purchase Order.

27. GOVERNING LAW

The Contract shall be governed by and construed in accordance with the substantive laws of the Republic of India.

28. SETTLEMENT OF DISPUTES

- 28.1.** The Parties shall use their best efforts to negotiate and amicably settle any disputes, controversies or claims arising out of, or in connection with, the Contract / Purchase Order or its interpretation.
- 28.2.** If the Parties fail to settle the dispute amicably within thirty (30) Days of commencement of the negotiations, the dispute shall be settled through arbitration. One (1) sole arbitrator shall be appointed by the Director of IITK who shall have full powers to make final and binding decisions subject to prevailing laws of India. The appointing authority shall be the Director of IITK. The place of arbitration shall be Kanpur and the language used in the arbitration proceedings shall be English.

29. PRIVILEGES AND IMMUNITIES

No provision of the Contract / Purchase Order shall be deemed, or interpreted as, a waiver of the privileges and immunities enjoyed by the IITK.

30. AMENDMENTS

No modification, amendment or change to the Contract/Purchase Order, or waiver of any of its provisions, or any additional contractual relationship with the Contractor shall be valid unless approved in the form of a written amendment to the Contract/Purchase Order, signed by a fully authorised representative of each Party.

31. VALIDITY

The invalidity in whole or part of any condition of the Contract / Purchase Order or clause thereof shall not affect the validity of the remainder of such condition or clause.

32. ENTIRE AGREEMENT

The Contract / Purchase Order constitute the entire agreement and understanding of the Parties and supersede any previous agreement, whether orally or in writing, between the Parties relating to the subject matter of the Contract.

33. GOVERNING LANGUAGE

The Contract / Purchase Order shall be executed in the English language which shall be the binding and controlling language for all matters relating to the meaning and interpretation of the Contract / Purchase Order.

Tender document

Department of Aerospace Engineering
Indian Institute of Technology Kanpur
Kanpur (UP) 208016 India

Enquiry date: April 1, 2021

Enquiry No: IITK/AE/UAY/2021/05

Online quotations are invited for “Combustor Test Rig”. The detailed specification is described below.

Detailed Specifications of the Combustor Test Rig

I. Brief description of the project

1.1 Brief scope of work

Scope includes Design, Engineering, Manufacturing, Assembly, Inspection, Supply, Transportation, Installation, Testing and Commissioning of all equipment/measurements listed.

The 3-cup combustor rig is divided into multiple sub-systems, given below:

- i. [Air flow circuit](#) – To provide the required amount of air at the required pressure and temperature, to the test section.
- ii. [Fuel flow circuit](#) – To provide the required amount of fuel to the test section.
- iii. [Cooling water flow circuit](#) – Cool hot exhaust gases to protect valve/plenum chamber.
- iv. [Ignition circuit](#) – Provide hot air for ignition of combustor housed within the test section.
- v. [Control & Data Acquisition](#) – Automatically regulate the various sub-systems to ensure that the required test conditions are achieved. Record & display all process parameters from various sub-systems.

A schematic of each of the sub-systems is detailed in later sections of this document. In each of the sub-system, the list of equipment/instruments to be supplied by the bidder is provided. The list of the components already available with the customer is also provided. The bidder will also provide the necessary hardware for Control & Data Acquisition as per the requirements specified in this document. The bidder shall integrate all the different equipment and provide a software program, for seamless operation of the Combustor Test Rig.

1.2 Bidder's Documents and Drawings

- All drawings shall use SI units.
- All graphical symbols to be recognized to industry standard.
- All text to be clearly legible when the drawing is reduced to A3 size. Drawings to be issued bound in A3 size. Hard copy of Quality & design dossier (Drawing to be on A3 format) for review.
- All drawings and calculations shall be checked, approved and signed by a competent and authorized person employed by the Contractor.
- All drawings shall be issued on Pen Drive in both Auto CAD & PDF formats.

1.3 Codes and Standards

The following National & International Codes & Standards of Latest editions shall be applicable.

- NFPA – 37: Standard For The Installation And Use Of Stationary Combustion Engines And Gas Turbines
- Applicable ANSI, ASTM, NEC, NEMA code.
- Standard Specifications of Bureau of Indian Standards (BIS).
- Specifications/Recommendations of IEC.
- Indian Electricity Rules.
- Indian Explosives Act.

- ASME / ANSI – B-31.3 Code for Process Piping

1.4 Precedence

In case of any conflict among the various documents, the following preferential order shall govern:

- Technical Specifications (tabulated)
- Data sheets/ drawings/ schematics
- International standards/codes as applicable
- Indian Standards / codes as applicable

Compliance with these specifications shall not relieve the bidder of the responsibility of furnishing equipment and accessories of proper design, material and workmanship to meet the specified operating conditions.

No deviations to the technical requirements and to the scope of supply specified in this enquiry document shall be accepted and offers not in compliance to the same shall be rejected. In case a deviation is required due to inherent design of the equipment offered, the bidder shall list all such deviations at one place giving reasons thereon.

1.5 Safety

- All controls shall operate in a fail-safe mode i.e. failure of any control shall not lead to running of equipment in unsafe mode.
- The hazardous area classification Class-I, Division I, Group D as per NEC or Zone I, Group II A/ II B as per IS/ IEC. Certificate from recognized agency to the effect that equipment supplied and/or installed conform to above area classification. All Devices shall meet the requirement for the specified area classification in which they are installed, including instrumentation leads.
- All exposed rotating parts shall be provided with adequate guards of non-sparking type.
- Piping shall be arranged in a manner so as to provide clear headroom and accessibility. Adequate clearances shall be provided for all the engineered components.
- All materials used shall be flame retardant.

For any clarifications, please contact:

Dr. Abhijit Kushari

Department of Aerospace Engineering

Indian Institute of Technology Kanpur

Kanpur 208 016, India

Ph: **0512-259-7126**

Email: **akushari@iitk.ac.in**

II. Operating Conditions

The conditions at which the Combustor Test Rig will be operated, are given in this section. Achieving the required operating condition is determined by measurement of pressure and temperature at Test Section Inlet (Fig. 1), along with the measured air mass flow rate and fuel flow rate in the respective flow circuits. These are the primary control parameters and the differential pressure (Dome dP/P) will be a limiting parameter, based on which ramp rates for different control parameters will be determined. The value of Dome dP/P is a defined parameter specific to this rig. The exact definition and the values would be supplied by the customer.

The Combustor Test Rig will always be started at a pre-set operating condition, termed as 'ignition condition'. Once the rig is started and all process parameters reach a steady state, the process parameters will be increased to achieve the specific operating conditions. The control system will be programmed to sequentially operate the various sub-systems, to start combustion and ramp the system to the ignition condition. Similarly, when ramping up from the ignition condition to the specific operating condition.

The combustor will be operated at every specific operating condition. At every operating condition, fuel flow will be varied within the min/max fuel flow rate given in the table. At every combination of operating condition and fuel flow rate, measurements of multiple process parameters will be taken. Following completion of all required measurements, fuel flow will be shut off immediately followed by N₂ purging and cooling of the hot parts. The operating conditions are given in Table 1 and a schematic of the test section is given in Figure 1.

NOTE: *The operating conditions given in the table are only representative. The final operating conditions for testing will be decided upon the system performance when all the components are integrated together.*

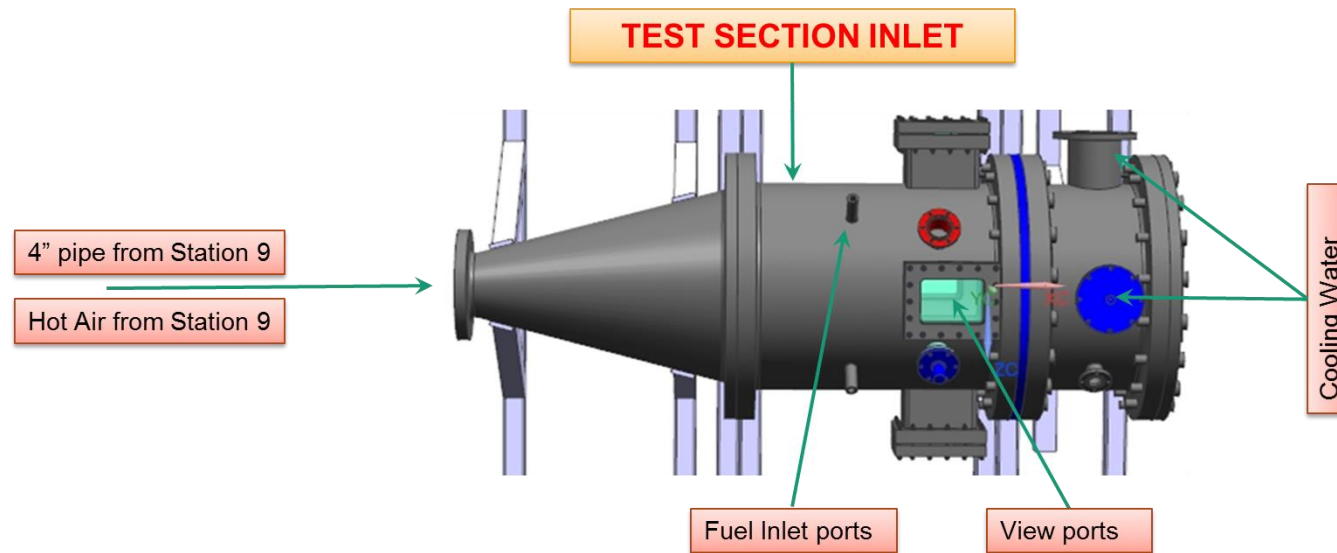


Figure 1: Plenum chamber of combustor test rig

Table 1: Operating conditions for the 3-Cup combustor test rig

	P_inlet (bara)	T_inlet (deg C)	W_inlet (kg/s)	Dome dP/P	Fuel Flow Rate (kg/s)		Fuel-air-ratio	
Ignition Condition	1.7	Ambient	0.43	4%	0.0043	0.0051	0.01	0.012
Test Condition 1	3	177	0.59	4%	0.0071	0.0118	0.015	0.023
Test Condition 2	4	221	0.91	4%	0.0136	0.0209	0.015	0.023
Test Condition 3	6	269	1.36	4%	0.0204	0.0313	0.015	0.023
Test Condition 4	10	316	2.04	4%	0.0306	0.0469	0.012	0.020

III. Site layout

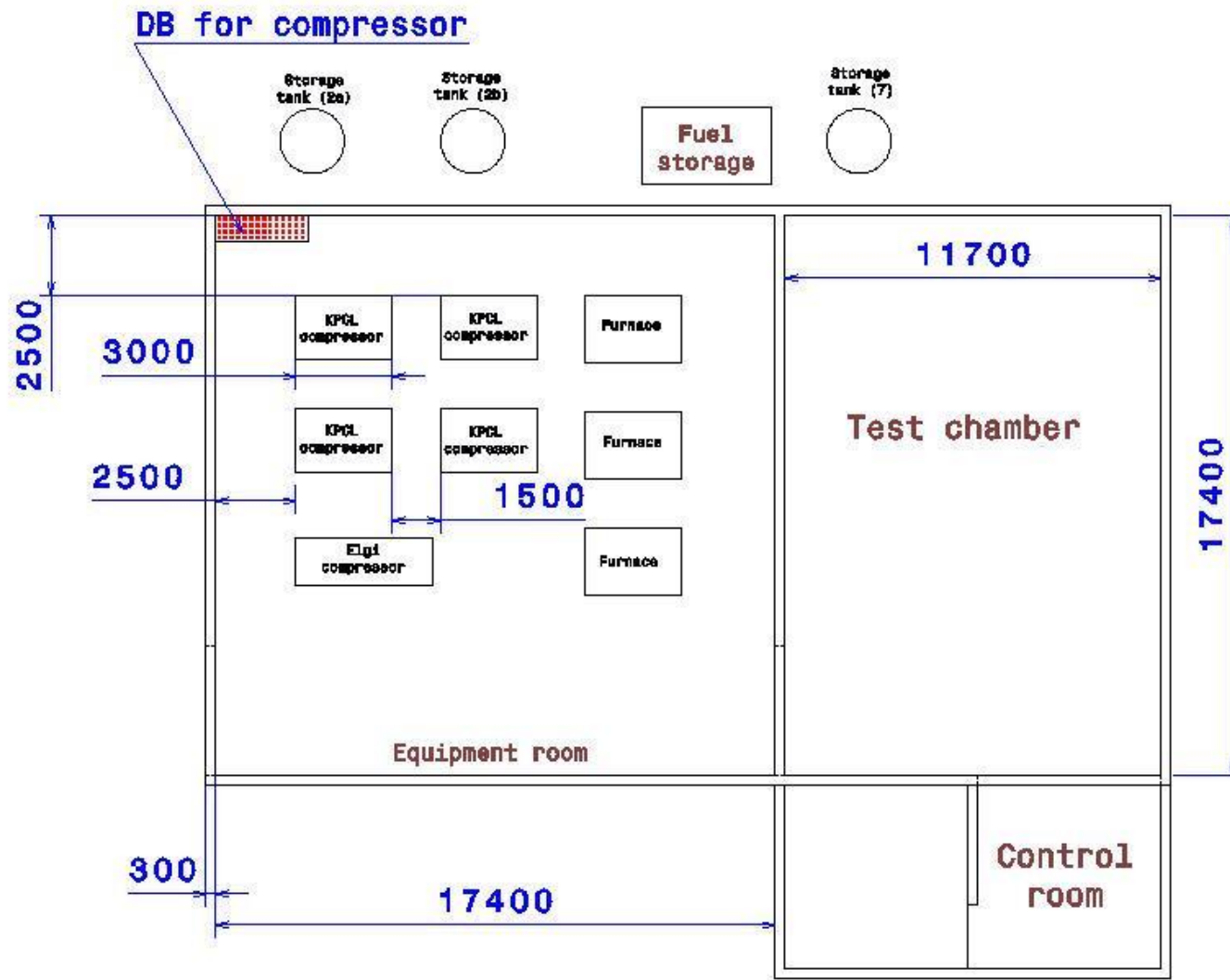
The site where the facility will be located is 18m x 30m shown in Fig. 2. The space is divided between the “Equipment room” and “Test Chamber”. The equipment room will house multiple compressors and furnaces, used to supply air at the required test conditions to the test chamber. The test chamber will house the Outer Plenum Chamber with a combustor housed within the plenum chamber (Fig. 1). The ignition circuit, a part of the fuel flow circuit and a part of the cooling water circuit will also be housed in the test chamber.

The layout in Fig. 2 has been prepared keeping in mind the requirements stipulated by the equipment OEM's. Based on their recommendation, adequate space has been provided around and between equipment. A rolling shutter access is provided for moving large equipment and will also serve as the emergency exit. The space in front of the rolling shutter will remain clear of any obstacles.

The equipment room and test chamber are on the ground level. The control room is at an elevated location (1st floor), with viewing windows. The control room will house all the data acquisition modules, along with computers and other necessary control hardware.

Based on the layout dimensions, bidders can plan the piping and wiring requirements. Provision has already been made for multiple MCB's, plug points and Ethernet ports, evenly distributed along all four walls in both the rooms.

NOTE: *Civil work and installation of the compressors, furnace and storage tanks will be in customer's scope.*



Equipment room, tests chamber and control room is provided with sufficient number of 5/15 Amps plug+switch, 32 Amps 3 phase MCB and 64 Amps 3 phase MCB distributed across the four walls.

The power for the compressors to be sourced from the DB located in the equipment room.

All dimensions are in mm

Figure 2: Site layout with equipment location

IV. Air Flow Circuit

The air flow circuit is designed to achieve each of the specific test conditions at Test section inlet, as given in Figure 1 and Table 1. The air flow circuit consists of two different air flow circuits, supplied by compressors having different ratings. The flow from both compressors will merge at Station 6, after the furnace. The four KPCL screw type compressors will be operated using a common microcontroller.

To achieve the required test conditions, it is necessary to combine / split the flow at Station 1, Station 3, Station 6 and Station 9, as shown in Figure 1. This is to be done with minimal losses while preventing backflow. A suitable arrangement has to be designed and implemented for the same.

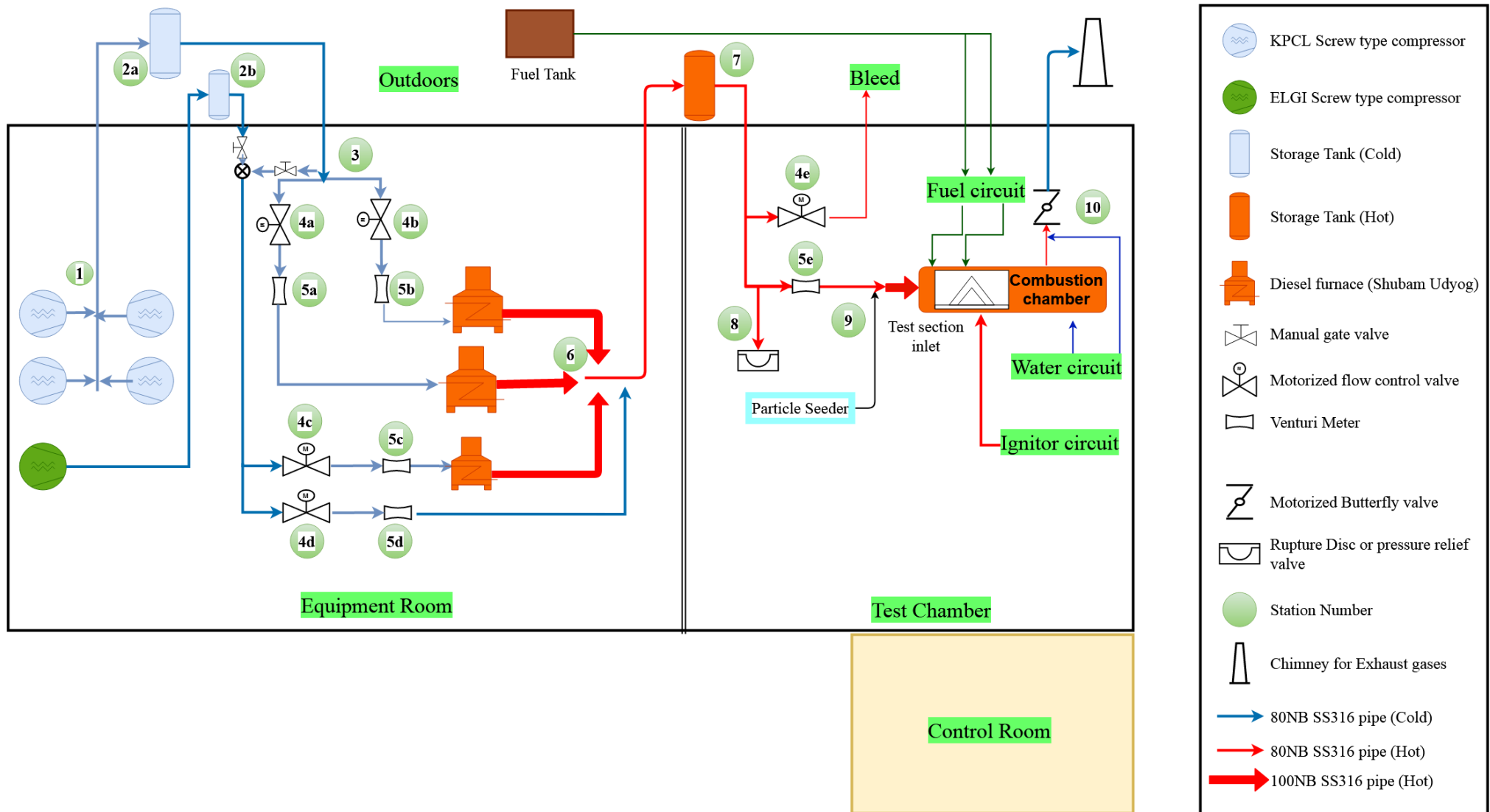


Figure 3: Schematic of air flow circuit

A. Details of available equipment/instrument (already available with customer)

Table 2: List of available equipment, Air flow circuit

Air Flow Circuit - Available Equipment			
Equipment Name	Make & Model	Qty	Description
Air Compressor (Diesel)	Elgi PG 1100S-300	1	Compressor air delivery pipe: 2 ½”. Free air delivery (FAD): 1100 CFM Max Operating Pressure: 20 barg Maximum exit temperature: Ambient+10 deg C Local controller for selection between two different load settings. Depending on setting, air pressure at delivery will be either 10 barg or 20 barg.
Air Compressor (Electric)	Kirloskar KES 160	4	Compressor air delivery pipe: 80 NB. Free air delivery (FAD): 758 CFM (21.46 m3/min) Operating Pressure: 12.5 barg Maximum / Unloading pressure: 13.0 barg Cut-in Reloading Pressure: 12 barg Maximum exit temperature: Ambient+50 deg C Common controller for all 4 compressors to regulate individual delivery flow rate and pressure. Communication using RS485 cable (Baud Rate: “9600”, Parity: “Odd”, Stop Bit: “1”, Data Bit: “8”)
Storage Tank (Station 2a)	BPM Industries, Thane	1	Working Pressure: 14 barg Design Pressure: 15.4 barg @ 100 deg C Air Inlet / Outlet: 80 NB Sch 80
Storage Tank (Station 2b)	-	1	Working Pressure: 20 barg Air Inlet / Outlet: 3”
Storage Tank (Station 7)	BPM Industries, Thane	1	Working Pressure: 11 barg @ 325 deg C Design Pressure: 12.1 barg @ 477 deg C Air Inlet / Outlet: 80 NB Sch 80

Diesel Fired Furnace	Shubham Udyog (3,60,000 KCAL/HR)	2	Max Outlet Temperature: 375 deg C Max air flow rate: 1.2 kg/s Max air pressure: 15 barg Burner Make: Unigas Italy (##) Air Inlet / Outlet: 100 NB Sch 40 Local Control panel.
Diesel Fired Furnace	Shubham Udyog (1,60,000 KCAL/HR)	1	Max Outlet Temperature: 400 deg C Max air flow rate: 0.5 kg/s Max air pressure: 20 barg Burner Make: Unigas Italy (##) Air Inlet / Outlet: 100 NB Sch 40 Local Control panel.
Motorized butterfly valve	Station 10	1	Pipe Size: 4 inches (NPS 4 / DN 100) Actuator Type: Electric (motor driven) Resolution: ±2 degrees Max operating temperature: 800 deg C Control signal type: 4-20 mA, 0 – 10V and HART.
Pressure Sensor (Station 2a, 2b)	JUMO dTRANS p30 404366/000-460-412-502-20-61	2	Parts in contact with medium: Stainless steel 316 Ti/316 L Range: 0..25 bara Output: 0.5... 4.5V Voltage supply: 5 VDC Response time: < 10 msec max
Pressure Sensor (Station 5a, 5b, 5c, 5d, 5e, 7, Test Section Inlet)	JUMO dTRANS p30 404366/000-461-412-502-20-61	6	Parts in contact with medium: Stainless steel 316 Ti/316 L Range: 0..16 bara Output: 0.5... 4.5V Voltage supply: 5 VDC Response time: < 10 msec max

NOTE:

- ✓ *All pressure measurements given in the above table will be supplemented with a Pressure gauge mounted at the same location, along with an isolation valve. Pressure gauge supply, isolation valve and installation will be in **scope of the bidder.***
- ✓ *Data sheets, GA drawings, P&ID diagrams and any other relevant material for the existing equipment, will be made available upon request.*

B. Details of required equipment/instrument (Scope of bidder)

Table 3: List of required equipment and measurement devices, Air flow circuit

Air Flow Circuit - Required Equipment and Measurements			
Equipment / Measurement Name	Location (refer schematic)	Qty	Description
Pipe Header or Storage tanks (used to divide or combine the flow)	Stations 1, 3, 6 and 9	4	<p>Station 1: To combine the flow from all four KES 160 electric compressors. Process connections are 80 NB Sch 80. <i>Max operating conditions same as exit conditions of Kirloskar KES-160</i></p> <p>Station 3: To divide the flow as required, to each diesel fired furnace. The air flow rate in each individual line will be regulated using the downstream flow control valve at Station 4a and Station 4b. Process connections are 80 NB Sch 80. <i>Max operating conditions same as exit conditions of Kirloskar KES-160</i></p> <p>Station 6: To Combine the flow from different furnaces. Max operating conditions: 116 m³/min, 15 barg and 450 deg C. Inlet Pipe size (coming from Diesel fired furnace): 100 NB Sch 40 Exit Pipe Size (same as Storage tank at Station 7): 80 NB Sch 80.</p> <p>Station 9: To Combine the air flow with a particle seeder. Max operating conditions same as Station 6. Inlet Pipe size (same as Storage tank at Station 7): 3" Exit Pipe Size (connecting to test section inlet): 4" Pipe size from particle seeder: 4"</p>
Motorized flow control valve	Stations 4a, 4b, 4c, 4d	4	<p>Maximum Line Pressure: 14 barg Maximum Line Temperature: Ambient + 50 deg C Maximum Flow Rate: 87 m³/min Process Connection: 3" Accuracy: ±1% Full Scale Manual override, position indicator, Remote operation and integrated to Control system 100% Tightness at fully differential pressure</p>

Motorized flow control valve	Station 4e	1	<p>Maximum Line Pressure: 14 barg Maximum Line Temperature: 450 deg C Maximum Flow Rate: 87 m³/min Process Connection: 4" Accuracy: ±1% Full Scale Manual override, position indicator, Remote operation and integrated to Control system 100% Tightness at fully differential pressure</p>
Motorized flow control valve	Extra	2	<p>Maximum Line Pressure: 14 barg Maximum Line Temperature: 450 deg C Maximum Flow Rate: 87 m³/min Process Connection: 4" Accuracy: ±1% Full Scale Manual override, position indicator, Remote operation and integrated to Control system 100% Tightness at fully differential pressure Two extra motorized flow control valves which can fitted in any line as required.</p>
Flow meter (air flow rate measurement)	Station 5a, 5b, 5c, 5d	4	<p>Maximum Line Pressure: 20 barg Maximum Line Temperature: Ambient + 50 deg C Minimum Flow Rate: 10 m³/min Maximum Flow Rate: 100 m³/min Process Connection: 3" Accuracy: ±1% of measured flow rate</p>
Flow meter (air flow rate measurement)	Station 5e	1	<p>Maximum Line Pressure: 20 barg Maximum Line Temperature: 500 deg C Minimum Flow Rate: 10 m³/min Maximum Flow Rate: 150 m³/min Process Connection: 4" Accuracy: ±1% of measured flow rate</p>
Pressure relief valve	Station 8	1	<p>To ensure that line pressure does not exceed 15 barg. Process Connection: 4"</p>
Pressure Sensor (Absolute)	Test Section Inlet	1	<p>Pressure: 0 - 11 barg Over Pressure Limit: 3x Full Scale Response time: < 1msec Accuracy: ±0.25% Full Scale</p>

Pressure sensor (Differential)	Various locations inside the Plenum chamber	25	Differential pressure. One end will be connected to a common reference pressure for all 25 sensors. The common reference pressure is the pressure measured at Test Section Inlet. Pressure: 0 - 1 bar Response time: < 1msec Accuracy: $\pm 0.25\%$ Full Scale Overpressure Limit: 3x full scale range
Temperature	Station 2a	1	K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Station 2b	1	K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Stations 5a, 5b, 5c, 5d	4	K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Station 5e	2	K type Thermocouple: 293 - 1260 deg C Accuracy: ± 1 deg C AND K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Stations 7	2	K type Thermocouple: 293 - 1260 deg C Accuracy: ± 1 deg C AND K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Test Section Inlet	2	K type Thermocouple: 293 - 1260 deg C Accuracy: ± 1 deg C AND K type Thermocouple: 0 - 275 deg C Accuracy: ± 1 deg C
	Station 10	1	K type Thermocouple: 293 - 1260 deg C Accuracy: ± 1 deg C
Humidity Measurement	Station 8	1	Measure the humidity content in the air prior to the Test section.
Non-return Valve	Station 6	3	Non-return valves to be installed at exit of each furnace. Can be included as a part of the header/storage tank at Station 6 OR can be provided separately. Flow conditions: 116 m ³ /min, 15 barg and 450 deg C. Inlet Pipe size (coming from Diesel fired furnace): 100 NB Sch 40 Exit Pipe Size (same as Storage tank at Station 7): 80 NB Sch 80.

NOTE:

- ✓ *The decision between the use of a pipe header or storage tank or any other system is **upon the bidder**. The process of combining the different streams of air should involve minimal pressure loss, and should not result in backflow and offer a uniform mixing over a short length. The process of splitting the flows should result in an even near equal distribution of the flow in the different streams. With these requirements, along with the flow conditions given above, the bidder can decide on an optimum method/system for combining or splitting the flow.*
- ✓ *Selection of the valve type for regulating the air mass flow rate is **upon the bidder**. The valve should be capable of operating at the conditions given, offer accurate control of flow rate and have minimal positional error.*
- ✓ *Selection of flow meter for measurement of air flow rate is **upon the bidder**. Preference will be given for low cost flow meters that are capable of operating over the entire range of flow rates, with an accuracy of $\pm 1\%$ of the measured flow rate.*
- ✓ *At the **discretion of the bidder**, additional components such as check valves, isolation valves, non-return valves etc. can be included, to ensure smooth operation and meet safety requirements.*

V. Fuel flow circuit

The purpose of the fuel flow circuit is to ensure that the required amount of fuel is delivered to the combustion chamber. The fuel used is aviation turbine fuel (ATF) or Jet A-1, sourced from IOCL. The fuel will be stored in storage tanks, placed in a fuel room near the Storage tanks (shown in site layout). The ball valve (BV1 and BV2) and coarse filter (F1 and F2) will be located near the fuel storage tank. The remainder of the flow circuit will be housed in the Test Chamber, starting with the fuel pump.

The VFD on the fuel pump, integrated with the control panel (in the Control room), will be used to regulate the fuel flow rate. The solenoid valves (SV5 & SV6) allow for testing the pump operation in a closed loop. This will be done before initiating the ignition sequence, allowing the fuel to enter the combustion chamber.

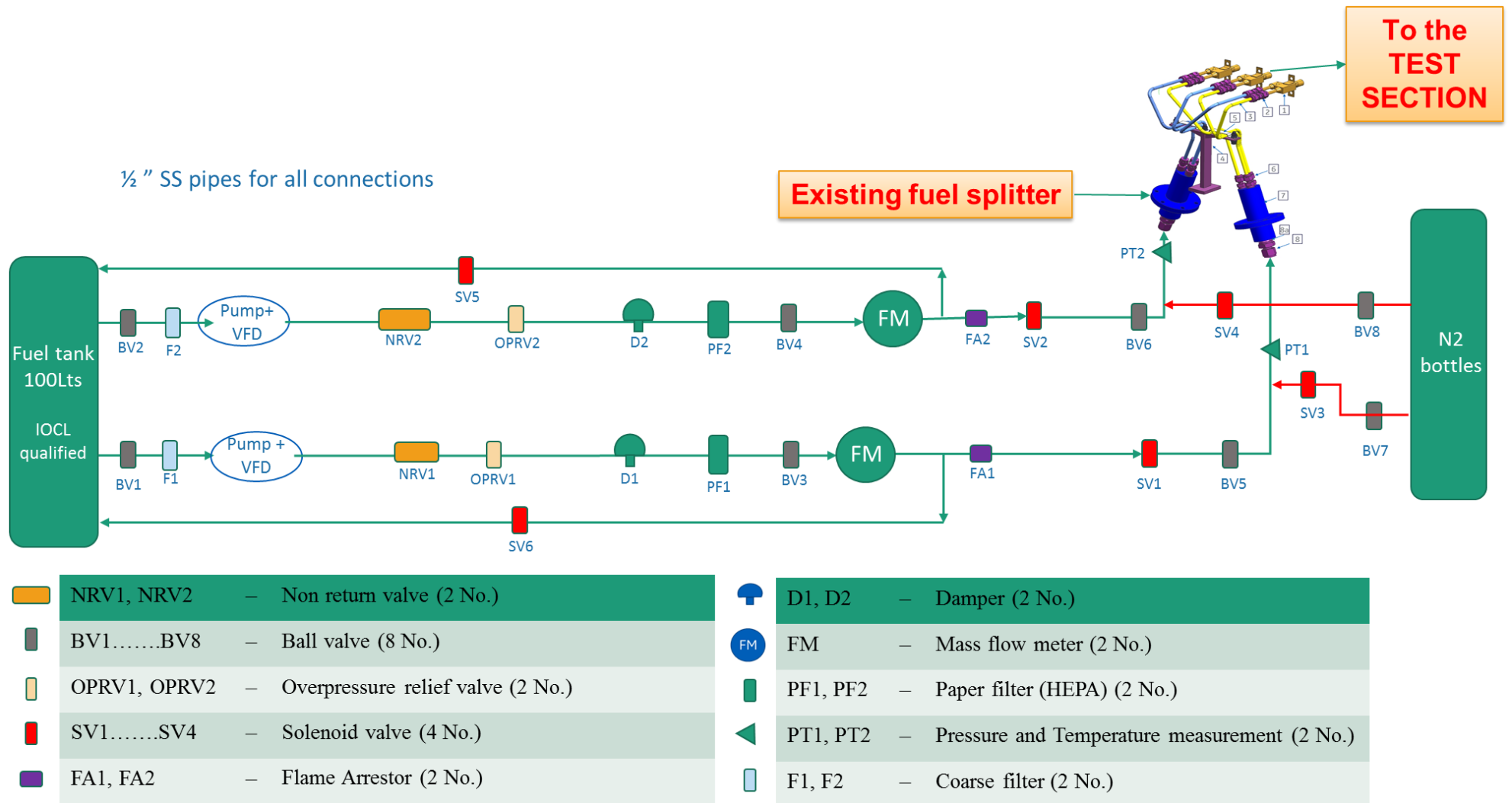


Figure 4: Schematic of fuel flow circuit

A. Details of available equipment/instrument (Scope of customer)

Table 4: List of available equipment, fuel flow circuit

Equipment Name	Make & Model	Qty	Description
Fuel Pump with VFD	PEC Pump PIGA 450 Gear Pump with VFD	2	Medium: Jet A-1 or Aviation Turbine Fuel Max delivery pressure: 30 barg Max fuel flow rate: 7.5 lpm Inlet and Exit pipe connections: 1/2"
N2 Bottles (pressurized cylinders)	-	1	Equipped with manually operated pressure regulating valve and on/off valve.
Fuel Splitter	Custom Design	2	-

B. Details of required equipment (Scope of bidder)

Table 5: List of required equipment and measurement devices, fuel flow circuit

Equipment / Measurement Name	Qty	Description
Fuel Tank (200 litre)	2	For storing Jet A-1 and Diesel. Fuel tank should conform to IOCL stipulated standards
Ball Valve	8	On/off valves for isolating sections of the flow circuit
Coarse Fuel Filter	2	Filtering of the fuel. Should be easy to remove and clean / replace
Non-Return Valve	2	Prevent back flow of the fuel in the flow circuit
Overpressure relief valve	2	To release excess pressure in case of excess pressure build up in the flow circuit.
Damper	2	Damp any flow oscillations caused by the pump or vibrating pipes.
Particulate filter	2	To filter smaller particles, that pass through the coarse filter installed earlier. (Should be easy to remove and clean / replace). Filter size: ≤ 10 microns Pressure drop: ≤ 0.5 bar differential
Fuel Flow meter-1	1	For measurement of fuel flow rate. Have a built-in head-mounted display. Measurement range: 0 – 40 kg/hr Max Line Pressure: 40 barg Accuracy: $\pm 0.5\%$ of full scale Linearity: $\pm 1\%$ of full scale Repeatability: $\pm 0.5\%$ of flow rate
Fuel Flow meter-2	1	For measurement of fuel flow rate. Have a built-in head-mounted display. Measurement range: 0 – 200 kg/hr Max Line Pressure: 40 barg Accuracy: $\pm 0.5\%$ of flow rate Linearity: $\pm 1\%$ of full scale. Repeatability: $\pm 0.25\%$ of full scale
Solenoid valve (SV1 & SV2)	2	On/off for the fuel line.
Solenoid Valve (SV5 & SV6)	2	On/off for closed loop fuel flow check.
Solenoid valve (SV3 & SV4)	2	On/off for the Nitrogen line. Operating pressure: 2 barg
Pressure Sensor (for Jet A-1)	2	Between BV6 and fuel splitter interface. Response time: < 1 msec Accuracy: $\pm 0.25\%$ Full Scale
Thermocouple	2	K-Type (0 - 275 deg C). Between BV6 and fuel splitter Accuracy: ± 1 deg C
Pipes and Fittings	-	1/2" SS pipes and fittings as required.

NOTE:

- *Max rated condition of pump delivery to be taken as operating condition (unless explicitly mentioned) for all components in the Fuel flow circuit.*
- *As far as possible, Fuel flow circuit should not have any expansion / contraction sections.*
- *The fuel is aviation grade Jet A-1 procured from Indian Oil Corporation Ltd. (IOCL), having a specific gravity between 0.775 and 0.84.*
- *Selection of flow meter for measurement of fuel flow rate is **upon the bidder**. Preference will be given for low cost liquid flow meters that are capable of operating in the entire range of fuel flow rates, with an accuracy of $\pm 0.5\%$ of the flow rate.*

VI. Cooling water circuit

The cooling water circuit is designed to provide:

- 1) Adequate cooling before the hot combustion exhaust gases reach the Butterfly valve at Station 10.
- 2) When required, cool the combustion exhaust gases before they reach the other walls of the plenum chamber.

The pump will be operated at a pre-set condition, for each Test condition. The pre-set condition will be decided by pump performance characteristics, as given by OEM, and the amount of cooling water required for that Test Condition. Piping between the overhead storage tank and Pump inlet will be 1". All other process connections will be 3/4".

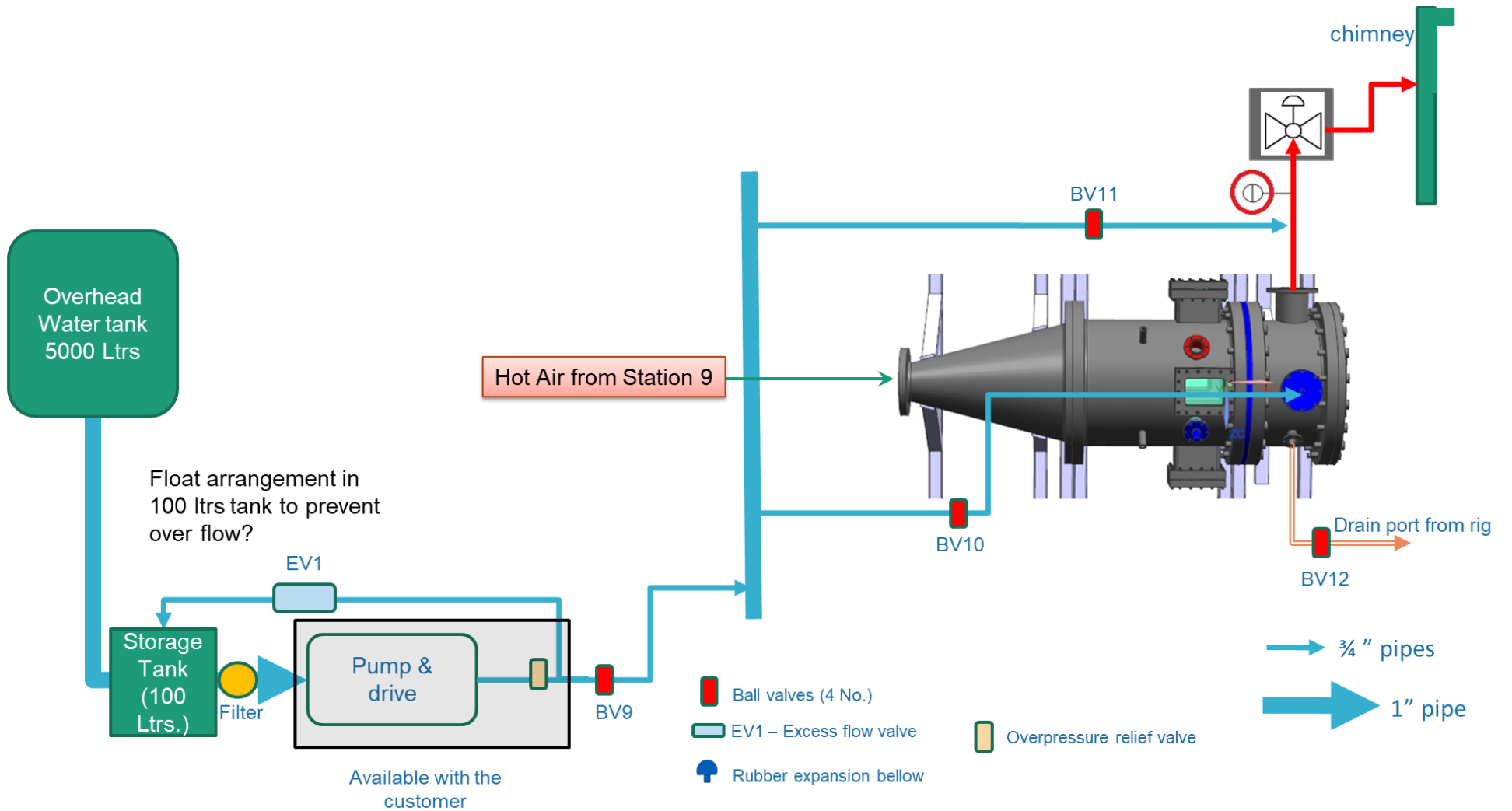


Figure 5: Cooling water circuit

A. Details of available equipment (Scope of customer)

Table 6: List of available equipment, cooling water circuit

Water Flow Circuit - Available Equipment			
Equipment Name	Make & Model	Qty	Description
Triplex Plunger Type water pump with VFD	Lynx XXT 70.15 (70 lpm @ 100 bar)	1	Medium: Water Max delivery pressure: 100 barg Max flow rate: 70 lpm Inlet pipe connection: 1" Exit pipe connection: 3/4"
Overhead Water tank (5,000 ltrs)	Generic	1	Will be placed at a height of 25 meters from ground level.
Water Storage Tank (100 ltrs)	Generic	1	Will be located in the test chamber.
Piping	Piping between overhead water tank, water storage tank and pump, will be in customers scope.		

B. Details of required equipment (Scope of bidder)

Table 7: List of required equipment and measurement devices, cooling water circuit

Water Flow Circuit - Required Equipment		
Equipment Name	Quantity	Description
Ball Valve	4	On/off valves to operate various lines, as required. Manually operated. Should be suitable for coarse control applications.
Level Indicator	1	Mounted inside the Water storage tank. Indicate water level.

NOTE:

Max rated condition of pump delivery to be taken as operating condition for all components in the cooling water flow circuit.

VII. Ignition circuit

The ignition circuit will be used to initiate combustion in the combustion chamber. The combustion chamber in the ignition circuit will be used to provide hot air to the main combustion chamber, for ignition purposes. This is similar to a pilot flame. Once the main combustion chamber achieves stable combustion at the required process flow conditions, the ignition circuit will be turned off.

During the ignition circuit, SV10 will remain closed and SV11 will remain open. Once the Ignition combustion chamber has achieved stable combustion (as denoted by a temperature rise in the thermocouple mounted on the combustion chamber), it will continue operating with SV11 open. When hot air is required for ignition of the main combustion chamber, SV10 will be opened and SV11 will be closed. Once the ignition circuit is turned off, SV10 and SV9 will close. SV11 and SV8 will remain open, until the ignition combustion chamber has cooled down sufficiently.

A. Details of required equipment (Scope of bidder)

Table 8: List of required equipment, Ignition circuit

Equipment Name	Qty	Description
Solenoid Valve (SV8)	1	On/off valves to provide air to the combustion chamber in the ignition circuit. Medium: Air Max line Pressure: 10 barg Max Temperature: Ambient Max flow rate: 1,000 lpm Pipe size: 1"
Solenoid Valve (SV9)	1	On/off valves to provide fuel to the combustion chamber in the ignition circuit. Medium: LPG Max line Pressure: 6 barg (air) Max Temperature: Ambient Max flow rate: 100 lpm Pipe size: ½"
Solenoid Valve (SV10 & SV11)	2	On/off valves to provide heated air to the Test section. Medium: Hot combustion products (air containing significant amounts of carbon dioxide and water vapour) Max line Pressure: 3 barg (air) Max Temperature: 1200 deg C Max flow rate: 1,000 lpm Pipe size: ½"

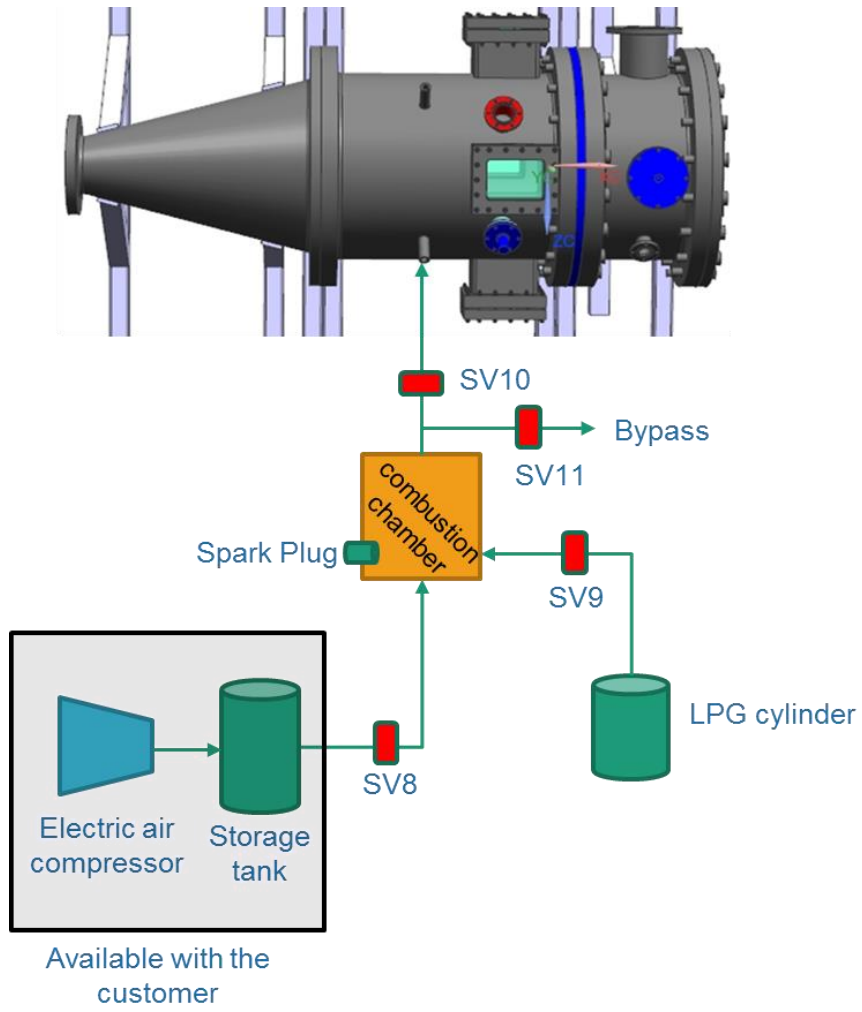


Figure 6: Ignition circuit

VIII. EMISSION measurement (Already available with customer)

The below given emission analysers are already available with customers.

Table 9: List of emission measurement devices

Emission Analysers				
Analyser	Detection Type	Make/ Model	Response time	Detection limit
CO	Non-dispersion infrared-ray(NDIR) absorption method	Fuji Electric systems co. Ltd® ZRE Type analyzer	60 s (90% in 15 s)	1 ppm
CO ₂			60 s (90% in 15 s)	0.5 ppm
CH ₄			60 s (90% in 15 s)	1 ppm
O ₂	Paramagnetic Sensing	MBE AG Messtechnik Engineering ® Parox 1200	<3 s	1.25 ppm
NO _x	Heated Vacuum Chemiluminescence	Signal Instruments Co. Ltd.® 4000 VM	1.5 s (5% to 95%)	0.2 ppm
UHC	Heated Flame Ionization detector (FID)	Signal Instruments Co. Ltd.® 3000 HM	2 s (5% to 95%)	0.2 ppm
Soot Measurement	Laser Induced Incandescence (LII)	Artium Technologies Inc. ® LII 300	20 Hz	0.2 µg/m ³ – 20 g/m ³ with an accuracy of ±2%

The above listed emission measurement devices will also be integrated with the data acquisition system. Customer will provide the details of the output signal type from the above devices. Bidder will have to plan for accommodating the same in the data acquisition module.

IX. Control and data acquisition system

The test rig is to be operated by the supervisory control and data acquisition (SCADA) system. The field instrumentation, controllers, human machine interface (HMI) and network connectivity for the SCADA system are to be supplied by the bidder. The choice of the architecture of the SCADA system is in the scope of the bidder. The field instrumentation should meet the requirements specified in this document. The specific choice of the controllers (if deemed necessary) rest with the bidder. However, the choice should meet the requirements specified in the operational sequence in **section IX.A**. The specifications and the exact number of controllers proposed by the bidder should be mentioned in the technical bid. The HMI should be through a graphical interface via a computer. The HMI should have indicators showing all the process parameters and should be able to take user input related to set-points. Other than the HMI provided by the bidder, the SCADA system should communicate all the measured process variables and the control inputs to a NI based software 'LABVIEW'. The details of the communication protocol should be provided by the bidder. The safety cut off sequence based on emergency situations and manual overrides also to be included to the software module. All the measured parameters and the control signals should be recorded in real time and saved data should be available in formats like .txt .xlsx .csv or others. The meta data like "Total rig run time", "Total number of runs" and History of all the runs (Include Date, time, location, user name) should be recorded and available to the administrator. The software modules should include password protection to make changes. Since, this is a facility for academic research, the HMI module should be flexible to incorporate changes in the future.

A. Tentative operational details

The tentative operational details are discussed in this section. The final version required may have minor deviations from the list given in this section.

1. Starting sequence (ignition condition)

1. Check the communication with all the devices.
2. Check the fuel flow circuit.
3. Close motorized flow control valves (4a, 4b, 4c, 4d and 4e). Butterfly valve fully open (10).
4. Ensure fuel circuit solenoid valves (SV1, SV2, SV3 and SV4) fully closed (No flow). Ensure upstream ball valves are open fully.

5. Ensure ignitor circuit solenoid valve closed (SV10 in the ignitor circuit).
6. Initiate N₂ purge of fuel line at atmospheric condition for 10-15 secs (manual). Shut-off N₂ purge
7. Start air compressors in the air circuit – Wait for the pressure in 2a (or 2b) to reach a pre-set value.
8. Open FCVs 4a-4d as required to start airflow through the rig. Adjust FCVs and exit butterfly valves to achieve Rig inlet pressure P₉ = 25psi, airflow = 1pps, dome dP/P will be ~3%
9. Start the heater. Heat the air to 300F. As air heats up, monitor the dome dP/P; it will start rising. Adjust FCVs and butterfly valve to achieve ignition condition: P₉ = 25psi, T₉ = 300F, airflow = 1pps, dome dP/P = 4% (+/- 0.3%). (Ignition envelope will be finalized based on ignitor trials)
10. Light-off ignitor; initiate ignitor start-up procedure. Confirm ignitor operation by thermocouple reading
11. Start quenching water supply. Set water flow to pre-calculated value as per requirement of ignition condition
12. Start fuel pump primary circuit. Set fuel flow to achieve ignition FAR ~ 0.012 (to be established in ignition trials. Confirm ignition by CCTV camera (or liner TCs). If ignition does not happen within 5 secs of fuel start, shut-down fuel supply
13. After the ignition is confirmed, shut-down the igniter circuit – Refer to the “Shut-down sequence of the igniter circuit”
14. The condition achieved is called “ignition-condition”.

2. Reaching test point

1. Open the motorized valves (4a-4d) to increase air-flow, and close the Butterfly valve in synchronization to raise the combustor pressure P₉. Achieve target P₉, dome dP/P (or mass flow rates), The exact ramp rates to be established in shakedown tests. T₉ will briefly drop due to increased air flow. Set desired inlet air temperature from the furnace, so that air temperature starts increasing.
2. Simultaneously, increase fuel flow rate using a combination of VFD attached to fuel pump and PFV so that fuel air ratio (FAR) is close to the ignition FAR (0.01 – 0.013) during transients. (ramp rates to be established in shakedown tests).
3. Wait until desired T₉ is achieved. Perform finer valve adjustments to maintain desired dome dP/P (or mass flow rates) and P₉, and adjust fuel flow rate to maintain 0.01 FAR. This is called “ramp-start” condition for the particular test point. Verify all parameters are stable at this point.
4. Adjust quench water flow to keep exit temperature within limits.

- Set desired FAR by increasing fuel flow to desired value. Simultaneously, increase quench water supply.

3. Shutdown sequence

- Return to the ignition condition at the test point once diagnostics is complete
- Switch-off the furnace. Combustor pressure drop will reduce (Is it better to shut-off the furnace, or reduce power level to ignition condition temperature?? Decide based on liner temperatures)
- Reduce air-flow and combustor pressure to idle condition by synchronized operation of the motorized FCVs and butterfly valve. The exact ramp rates to be provided.
- Once ignition condition is achieved, shut-off fuel flow by following fuel shut-down sequence.
- Start N₂ purge. Shut off quench water supply
- Wait for sufficient time till the combustor cools down
- Close the motorized valves (4a – 4d), and open butterfly valve
- Open drain port on the rig to drain accumulated water

4. Emergency shutdown

- Switch on emergency alarms (in the lab and outside)
- Close LPG supply valve (if open) and fuel flow valves.
- Switch off fuel pump and solenoid valves.
- Shutdown the furnace.
- Switch off water supply – pump off
- Close motorized gate valves to “safe position” – low flow
- Open butterfly valve (10)
- Turn on nitrogen purge for fuel circuit
- Fully close motorized valves (4a-4d)
- Shut down all Electrical system

B. Parameters measured by SCADA

The following parameters are to be monitored continuously and associated equipment to be used to vary flow conditions.

Parameter	Equipment involved
Combustor inlet pressure P9	Motorized valves (4a-4d, 4e), exit butterfly valve (station-10)
Combustor inlet temperature T9	Furnace controls

Dome pressure drop	Motorized valves (4a-4d, 4e), exit butterfly valve (10)
Total air flow 5a+5b+5c+5d, 5e	Motorized valves (4a-4d, 4e), exit butterfly valve
Fuel flow rate – primary	Primary Fuel pump & VFD, solenoid valves opening closing
Fuel flow rate – secondary	Secondary Fuel pump & VFD, solenoid valves opening closing
Total fuel air ratio	Needs to be achieved & monitored
Exit temperature before Butterfly valve	Quench water pump & VFD
Pressures in the combustion chamber	Approximately 25 locations

NOTE: *The SCADA system should be extendable to include 50% extra channels, for pressure, temperature or any other additional measurements.*

X. PIPING

- The process piping for every flow circuit shall conform to ASTM / ASME standards.
- All process piping shall be done using seamless Stainless steel pipes/tubes (SS 316/316L).
- The hardness of the pipes/tubes shall be less than 80 RB.
- The pipe size requirements for every individual flow circuit, is provided in their respective sections.
- Piping in the air flow circuit shall be arranged in a manner so as to provide clear headroom and accessibility.
- Piping for the fuel flow circuit will run along the ground level, with adequate provision for clamping and supports, to prevent vibrations.
- Adequate clearances shall be provided for all the engineered components, allowing for easy removal and replacement / maintenance.
- Summary of the Piping requirements:
 - Air flow circuit: 3" and 4" pipes, as shown in the schematic
 - Entire fuel flow circuit: 1/2" pipes, as shown in the schematic
 - Cooling water circuit: 3/4" pipes, as shown in the schematic
 - Any other piping required to complete any of the flow circuits listed earlier.

Scope of the Bidder:

- Plan the piping requirements for every flow circuit. The piping diagram should include details of pipe sizes, pipe lengths, supports, flanges, elbows, couplings, unions, tees, crosses, Y-bends, bushings, reducers, gaskets, non-return valves, isolation valves and any other essential components that are required for the completion of every flow circuit.
- Provide a detailed drawing of the same to the customer along with the factor of safety and margin of safety for every component.
- Identify a suitable vendor capable of supplying the pipe, as per the specifications & design of the bidder.
- Initiate purchase and procurement of the same in a timely manner.

XI. WIRING

Scope of the Bidder:

- Plan the wiring requirements for all equipment and instruments installed in every flow circuit. This includes junction boxes, conduits, signal conditioners, signal booster, terminal blocks, relays, fuses, panels, enclosures, PLC's and other components required for transmitting the signals to the data acquisition & control system located in the control room.
- Ensure that all transmitted signals are adequately protected from interference, reducing the noise in the signal received by the data acquisition & control system.
- Provide a detailed drawing of the same to the customer.
- Identify a vendor capable of supplying suitable cable types and in the required lengths length's, for connecting the various components.
- Initiate purchase and procurement of the same in a timely manner.

XII. CALIBRATION AND CERTIFICATION

- All equipment and instruments should be supplied with a certificate of compliance, confirming their adherence to the required performance and safety requirements.
- The calibration will be carried out for the full range of operability for these devices / instruments, as given in the tabulated requirements for every flow circuit.

XIII. General requirements

1. All the equipment, instruments, electrical equipment and control systems shall adhere to the safety norms mentioned earlier in this document, as per the area classification, for both mechanical and electrical systems.
2. Emergency power shutdown switch to be provided in the control room. Activation of this switch, should turn off the entire experimental rig and if possible, initiate emergency shutdown sequence.
3. All package mounted sensors, transmitters & temperature elements shall be intrinsic safe as per IEC 79-11 and solenoid valves, switches and related junction boxes shall be flame proof 'd' as per IEC 79-1.
4. Other special equipment / instruments, where intrinsic safety is not feasible or available, shall be flameproof/ explosion proof as per IEC 79-1.
5. All pressure gauges shall have an accuracy of +/- 1% of FSD (full scale division) and 100mm dial size. Pressure sensing elements shall be minimum of SS316 and movement of SS304.
6. Flow meters shall be suitably installed and clamped as per OEM guidelines/recommendations to avoid measurement errors due to external vibration. Relevant calibration certificates to be provided.
7. Individual (2/3 core) cabling is required for each field instrument from the field Junction box to avoid multiple Junction Boxes and multicore cables in the field for easy troubleshooting & replacement.
8. Each cable shall be neatly tagged & dressed for each instrument with ferrule.
9. There shall be provision of relay for DO cards between PLC & SOV & barriers/ isolators for DI cards between field & PLC (if used). The barriers and isolators should be either single or double channel in place of multichannel for easier replacement.
10. All the instrumentation shall be capable or operating for full range of operation.
11. Separate junction boxes shall be provided for each type of signal i.e. analog, digital, solenoids RTD, thermocouple, intrinsic safe and for power supply. No cable shall share power & signal.
12. Suitable bypass for interlocks shall be provided for start-up.
13. Redundancy in PLC (if used) is required. PLC (if used) shall incorporate all process parameters (specified elsewhere) and status of all equipment in the Air circuit, fuel circuit, water circuit and ignition circuit. Priority panels shall be modular in construction with 100% redundancy with respect to CPU, Power supply, Interface.

14. All components/ systems like PLC or systems located in the Equipment room and the test chamber shall be tropicalized, MIL standard adopted with complete wiring and necessary terminals. Wiring to be colour coded with cross ferruling in position.
15. PLC (if used) shall be capable of carrying out on line routines for at least ten separate loops without affecting the scan, cycle & updating time etc. PLC (if used) shall be configured as a remote terminal unit of supervisory computer and data acquisition system complete with Ethernet connectivity.
16. In case of failure of master/ active controller/ CPU, standby controller/ CPU should take over the control in a seamless and bumpless manner. All values & data should be available through both the controllers immediately, i.e. there should be no data loss. PLC shall be housed inside flameproof IIA/ IIB (Ex'd').
17. Local operator panels shall also be provided on the flameproof enclosure. The operator panel is provided for parameterization, indication, monitoring, and alarms and first out sequence of the system.
18. PLC (if used) systems shall have memory modules for storing user programs, symbol lists, program comments and should facilitate debugging/ troubleshooting without the application program.
19. Program shall be as per IEC 61131 and communication shall be in English for each run.
20. Programs should have signal/ parameter tags as labels for easy identification/ troubleshooting.
21. Each section of the program whether it is in the form of rung or page or network should have a comment to classify the interlock being executed.
22. Bidder to ensure that spares and service support of all equipment, measurement devices and other components used in completion of the various flow circuits, shall be available in the Indian market.
23. All equipment must be compatible with Indian electrical standards and codes. Engineering documentation on the physical sizes and weights of all major and minor components must be submitted.
24. Semiconductor fuses to be provided, where applicable.
25. All illumination fittings should be single phase AC supply based.
26. All wire/ cable to be used shall be of copper conductor and FRLS type through proper cable tray conduit etc.
27. The output signals from all the sensors should have the option of using 0-10V or 4-20 mA, over and above whatever other communication protocol is already available in that device.

28. Any equipment requiring a supply power other than 220/230V AC, should have their own step up/step down modules to regulate the voltage to the desired value. Customer will only provide supply power outlets of 220/230V AC.

XIV. List of items to be included in the technical bid

- The technical bid should contain a comprehensive list of all the equipment and instruments to be supplied by the bidder. For each equipment / instrument, the following details are mandatory:
 - ✓ Make and model
 - ✓ Data sheet with technical specifications
- Details of piping material for each individual circuit, along with the specifications of the pipe material.
- P&ID diagram for every flow circuit.
- Wiring diagram for all instruments / equipment.
- Proposed timeline for completion, with clear milestones for every phase (procurement, delivery, installation, control system design etc.)

Terms and Conditions:

1. All equipment must be compatible with Indian electrical standards and codes. Engineering documentation on the physical sizes and weights of all major and minor components must be submitted.
2. TENDER Specific Manufacturer Authorization Form from OEM Required.
3. The Institute reserves the right of accepting or rejecting any/all quotations without assigning any reason thereof.
4. All prices should be **F.O.R.**
5. Installation by OEM is preferred.

TENDER ACCEPTANCE LETTER
(To be given on Company Letter Head)

Date: _____

To,

Sub: Acceptance of Terms & Conditions of Tender.

Tender Reference No: _____

Name of Tender / Work: -

Dear Sir,

1. I / We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely: _____ as per your advertisement, given in the above mentioned website(s).
2. I / We hereby certify that I / we have read the entire terms and conditions of the tender documents from Page No. _____ to _____ (including all documents like annexure(s), schedule(s), etc .), which form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.
3. The corrigendum(s) issued from time to time by your department/ organisation too have also been taken into consideration, while submitting this acceptance letter.
4. I / We hereby unconditionally accept the tender conditions of above mentioned tender document(s) / corrigendum(s) in its totality / entirety.
5. I / We do hereby declare that our Firm has not been blacklisted/ debarred/ terminated/ banned by any Govt. Department/Public sector undertaking.
6. I / We certify that all information furnished by our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then your department/ organisation shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,
(Signature of the Bidder, with Official Seal)

Certificate for Tender
(To be given on Company Letter Head)

Date: _____

To,

Sub: Certificate of compliance as per Rule 144 (xi) GFR's 2017

Tender Reference No: _____

Name of Tender / Work: -

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Yours Faithfully,
(Signature of the Bidder, with Official Seal)

Certificate for Tender for Works involving possibility of sub-contracting
(To be given on Company Letter Head)

Date: _____

To,

Sub: Certificate of compliance as per Rule 144 (xi) GFR's 2017

Tender Reference No: _____

Name of Tender / Work: -

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Yours Faithfully,
(Signature of the Bidder, with Official Seal)

Declaration for Local Content

(To be given on Company Letter Head - For tender value below Rs.10 Crores)

(To be given by Statutory Auditor/Cost Auditor/Cost Accountant/CA for tender value above Rs.10 Crores)

Date: _____

To,
The Director,
Indian Institute of Technology Kanpur,
GT Road, Kalyanpur, Kanpur -208016

Sub: Declaration of Local content

Tender Reference No: _____

Name of Tender / Work: -

4. Country of Origin of Goods being offered: _____
5. We hereby declare that items offered has _____% local content.

“Local Content” means the amount of value added in India which shall, be the total value of the item being offered minus the value of the imported content in the item (including all customs duties) as a proportion of the total value, in percent.

*“*False declaration will be in breach of Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.”*

**Yours Faithfully,
(Signature of the Bidder, with Official Seal)**

Bid Security Declaration
(To be given on Company Letter Head)

Date: _____

To,
The Assistant Registrar
Central Stores
IIT Kanpur-208016

Sub: Certificate for bid security declaration

Tender Reference No : _____

Tender ID : _____

Name of Tender / Work: -

"I/We have read the clause regarding Bid Security Declaration/Earnest Money Deposit and I/We are fully aware that if I/We withdraw or modify the bid during the period of validity I may be suspended for a period of 3 years ."

Yours Faithfully,
(Signature of the Bidder, with Official Seal)