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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<u>SPECIFICATION FOR COMPRESSOR CONTROL SYSTEM</u> <u>(ANTISURGE, PERFORMANCE, LOADSHARING)</u>			
Ref. Doc	Revisions : Refer to record of revisions :	Prepared : (PRIYANKA)	Approved : (RAM)	Date : 04.04.18	

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		<u>INSTRUCTIONS TO BIDDERS:</u> a) Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of Enquiry. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected without any further correspondence with the Bidder. b) Unsolicited requests from bidders for alterations to their already submitted offer will not be permitted. These would not be taken cognizance, and offers will be evaluated without taking into account such requests/correspondence. c) Any technical features over & above BHEL enquiry specification requirements proposed by Bidder will not be given preference for the purpose of evaluation. d) Bidders shall comply BHEL specifications in total. Incomplete offers will be rejected. In case feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder. e) Bidders are advised to quote models and makes with proven track record of successful operation. Offers shall include supporting catalogue and published literature {duly highlighting, as appropriate, the offered variant} with complete de-codification of the offered models. In case of discrepancy between bidder's offer and published documents, details furnished in published documents will be taken for the purpose of evaluation. f) In the event of any conflict between these specifications, data sheets, related standards, codes etc. the bidder shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture/procurement of the items in question. g) Bidder shall submit duly filled deviation format enclosed with this specification along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be rejected. If, there are no deviations, bidder shall submit signed copy of deviation format, mentioning "No Deviations". h) Changes if any made by BHEL during technical evaluation on the specification requirements or Bill of material, bidder is requested by the purchase to submit impact price (amount to be reduced or increased to the original offered price) for those changed items only, other items for which there are no technical changes, unit rates shall be maintained as it is. i) Bidder has to quote for all the items required for implementation of Enquiry as a complete package, exclusion of any item is not acceptable and the offer will be rejected. j) Bidder shall submit 'filled-in PQR document' if provided along with enquiry. k) In case of any technical query, bidders may contact the following BHEL engineer: Name: Priyanka Ghosh Designation: Senior Engineer Deptt: TC Engineering Phone: +91 40 2318 4162 Email: priyankagh@bhel.in		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.			• The operator interface system (HMI) shall be capable of following functions: ○ Engineering and configuration of Compressor Control System application software. ○ Loading / Unloading / backup of Compressor Control System application software. ○ Compressor Control System Graphic Screen (Compressor maps with operating point, surge / antisurge lines / margins. Vendor shall develop graphic screens required for monitoring, operation and annunciation purpose during detailed engineering stage and furnish the screens for approval. ○ Compressor Control System Historian / SOE. ○ Capability to transfer / export Historian data / SOE to MS Excel. • The HMI Workstation shall be supplied with applicable Compressor Control System software for the above listed functions shall be supplied with valid license. The software license shall not be time bound or limited to specific period of use (like valid for 1 year etc.). The software license shall not expire after a certain period. • The HMI Workstation shall be supplied with antivirus software, valid for atleast 3 years from date of activation. The Antivirus shall be activated during commissioning of compressor control system. • The complete software backup image of As-Shipped HMI workstation shall be supplied in a USB. • A second software backup image of the As-Commissioned HMI workstation shall be created after commissioning and a copy of the same shall be submitted to BHEL. d) If specified, a laptop PC shall be supplied with Compressor Control System configuration (modification of setpoints, system tuning etc., uploading and unloading of controller application). e) Vendor shall be fully responsible for the complete design of Compressor Control System. Vendor shall guarantee the performance of the machine with the offered system. Wherever required, Compressor Control System shall be designed in such a way that it is capable of correcting the compressor operating point so as to avoid surge in order to protect machine from possible damage, to minimize process upsets and to minimize recirculation, achieve the desired operating point and loadsharing (in case of parallel compressor trains, if applicable). f) Vendor shall supply all the hardware and software related to the operation and safety of the compressor. This shall include but not limited to the following: i. Design and operation of surge control loop, Performance & loadsharing (if specified) scheme based on offered compressor performance. ii. Vendor shall supply all hardware in Compressor Control System including dedicated controller, programming system, software, communication converters, cables etc.; excluding the field devices like transmitters, measuring elements, final control elements etc., which shall be supplied by purchaser. iii. Algorithm required for anti-surge, Performance & loadsharing control applications (as applicable). g) The compressor control system controller hardware shall be a dedicated single loop controller on proprietary Hardware Platform or single / multi loop controller of	
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		common hardware platform such as PLC. The compressor control system controller shall be dedicated controller for each AntiSurge, Performance and loadsharing control application / Tag. Dedicated panel mounted facia / Display with keypad shall be provided for each controller application / tag. It should be possible to change / modify the CCS configuration from this facia / display. Incase vendor provides a display without keys / provision for configuration / setpoint modification, vendor shall include a laptop along with configuration software in its scope. If a panel is specified, a panel mount type configuration PC shall be preferred. h) Multiple applications / controllers shall NOT be clubbed in a single controller hardware. Example: A compressor control system with antisurge & performance control for Two stage compressor shall have Three dedicated controllers (i.e. ASC-1, ASC-2 & Perf) in simplex (non-redundant) configuration or Six dedicated controllers with redundant IO hardware / switch when Redundant configuration is specified. i) In case multiple applications are required for compressor control system, the controller hardware shall be identical for all compressor control applications in terms of CPU, IO card, Communication card, terminations etc. Only the controller front facia may differ based on application requirement. j) Compressor Control System should be able to accept 4-20 mA signal from field or from HIC at purchaser DCS or at LCP as a manual override (external setpoint like Remote Low Clamp for Antisurge etc.) with bump less transfer. k) Auto-manual operation with bump less transfer shall be provided. l) The controller response time (total time to read input, processing time and output) shall be as per the machine dynamics and safety and shall be maximum 40 milliseconds. Any faster response required based on machine dynamics shall be considered by vendor. The input sampling interval shall be as per machine dynamics within the controller response time as above. The processor cycle time shall be considered to meet the overall response time. m) The Compressor Control System shall be field proven, specific to the make of machine and for the similar application in hydrocarbon industries. Vendor shall provide the proven track record for the offered system meeting the above criterion. n) The Compressor Control System application algorithm shall be implemented using standard firmware in the controller / processor system. o) If specified, Compressor Control System shall be based on redundant hardware on hot standby with bump less transfer. p) The algorithm developed by vendor shall be specific for given application, surge control, performance, load sharing etc. and shall be field proven for the compressor make. q) The algorithm implemented in the system shall be protected against any unauthorized modifications / changes. r) The configuration shall be stored in non-volatile memory or battery back-up for configuration shall be provided (minimum 72 hours) in case of volatile memory along with battery drain indication. s) Compressor Control System shall not be used for performing any other machine related protection interlocks / logics.		
		2.2 TECHNICAL REQUIREMENTS-GENERAL: a) The input signals shall be 4-20mA, 2 wire and powered from the controller.		

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. b) The controller shall monitor each transmitter input signal for high and low values. Alarm limits shall be set at 95% increasing and 5% decreasing signals. When a transmitter input signal exceeds the alarm limit, a relay will de-energise to actuate a command “transmitter out of range” alarm (alarm by others) in the control center. The controller output signal shall de-energise a relay at 95% decreasing value to actuate “Controller operating” alarm (by others) in the control room. c) The controller shall monitor its output and initiate an alarm if output failure is detected. d) The controller shall be designed with a fail-safe mode to prevent a process upset caused by a transmitter or input failure. The controller vendor shall specify the fail-safe mode required for each specific installation. e) The performance of system design that integrates process control, loadsharing etc. with antisurge control shall be the responsibility of the antisurge controller vendor. f) One number of analog (4-20mA) output is required from each controller (configured identical to controller output to anti surge valve) for indication at Local control panel / DCS to achieve bumpless transfer in manual mode. g) The inputs considered for Antisurge control: Suction Flow, Suction pressure and temperature, Discharge pressure and temperature. The algorithm shall be selected accordingly. h) The inputs and outputs for Performance / loadsharing etc. if applicable, shall be decided as per the project requirements. 2.3 <u>TECHNICAL REQUIREMENTS-IO SUMMARY:</u> a) The IO count listed below is the hardware IO's for <u>EACH</u> Compressor Control System Controller hardware. Each controller used for Compressor Control System (Antisurge, Performance / loadsharing etc.) shall have following number or a total No. of Inputs/Outputs minimum as follows. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sl. No</th> <th>Description</th> <th>IO Count</th> </tr> </thead> <tbody> <tr> <td>i</td> <td>Digital Inputs (24V DC)</td> <td>07</td> </tr> <tr> <td>ii</td> <td>Digital Outputs (1A, 28VDC)</td> <td>05</td> </tr> <tr> <td>iii</td> <td>Analog Input (4-20 mA)</td> <td>08</td> </tr> <tr> <td>iv</td> <td>Analog Output (4-20 mA)</td> <td>02</td> </tr> </tbody> </table> b) The above I/O's do not include the no. of I/O's required redundancy module (if Compressor Control System is specified as dual-Redundant) & auto testing facility. Vendor shall include the IO Hardware (Redundancy Switch etc.) for redundant control system. c) In case the vendor offer is considering higher IO based on the standard modules available, all the IO shall be wired up to terminal box in the panel. 2.4 <u>TECHNICAL REQUIREMENTS-SYSTEM PANEL (if specified):</u> a) If specified, the Compressor Control System shall be supplied in fully assembled, wired and factory tested panel. The specifications for panel are as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sl. No.</th> <th>Requirement</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Environment</td> <td> a. Ambient Temp: 1-40 °C b. Humidity: 10-100% c. Hazardous Area classification: NA. Field Instruments </td> </tr> </tbody> </table>					Sl. No	Description	IO Count	i	Digital Inputs (24V DC)	07	ii	Digital Outputs (1A, 28VDC)	05	iii	Analog Input (4-20 mA)	08	iv	Analog Output (4-20 mA)	02	Sl. No.	Requirement	Description	1	Environment	a. Ambient Temp: 1-40 °C b. Humidity: 10-100% c. Hazardous Area classification: NA. Field Instruments
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. <table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 10%;">Sl. No.</th> <th style="width: 30%;">Requirement</th> <th style="width: 60%;">Description</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td> power. Pre-Fab cables as per manufacturer standard. c) Wiring colour code: provided during detail engineering. d) Ferrules: Cross ferruling with White / Yellow silicon type, printed. e) Terminals: screw less, clamp-on type (Wago, Phoenix, Weidmuller) f) Earth / Grounding: Yes, signal and power earth with Earth Bus Bar (6mm thick) and lugs. g) Incoming power: i. UPS: 110 or 240VAC-Redundant Feeder (provided during detail engineering) ii. Non-UPS: 240VAC-Single Feeder </td> </tr> <tr> <td>9</td> <td>Cable glands</td> <td>SS / Nickel-Brass material and double compression type</td> </tr> <tr> <td>10</td> <td>Exhaust fans and louvers</td> <td>Yes, back door / top mounted and louvers.</td> </tr> <tr> <td>11</td> <td>Installed Spare</td> <td>20% for MCB, Power Supply, Power and Signal Terminals, Relays, Barriers etc.</td> </tr> <tr> <td>12</td> <td>Interposing Relays</td> <td>Yes for DI & DO</td> </tr> <tr> <td>13</td> <td>Isolators / Barriers</td> <td>Yes for AI / AO</td> </tr> <tr> <td>14</td> <td>Surge Protector</td> <td>Yes for Power Supply and Communication</td> </tr> </tbody> </table> 2.5 <u>TECHNICAL REQUIREMENTS- COMMUNICATION:</u> a) Each controller shall be interfaced with the customer's DCS via dual redundant RS485 MODBUS RTU or Modbus TCP (to be finalized during detail engineering) link. Vendor shall ensure that each controller shall be provided with TWO number of communication ports for above. b) If HMI is specified, a dedicated communication port shall be provided on each controller for connection with HMI / programming & configuration PC. Vendor shall provide all communication hardware & software and other networking accessories like Ethernet Switch (if required) at both ends for redundant communication network with HMI PC. c) In some cases, if the cable distance between Control System and HMI PC is very large, If HMI-PC communication may be specified as fiberoptic. Vendor shall provide TWO sets of DIN rail mount type Fiber Optic Converters with LIU and patch cords along with 24VDC power supply. The fiberoptic cable shall be single mode type, minimum 6 cores and orange colour, armoured type. The fiberoptic cable shall be routed through orange coloured HDPE conduit of size ¾". 2.6 <u>TECHNICAL REQUIREMENTS – INSPECTION & TESTING:</u> a) Bidder to furnish the QA plan & FAT procedure along with the data sheets of all the equipment in line with BHEL specifications for approval after placement of order. b) The controllers / fully assembled system (if applicable) shall be tested in an integral manner by simulation. Customer / Consultant / BHEL and/ or BHEL authorized					Sl. No.	Requirement	Description			power. Pre-Fab cables as per manufacturer standard. c) Wiring colour code: provided during detail engineering. d) Ferrules: Cross ferruling with White / Yellow silicon type, printed. e) Terminals: screw less, clamp-on type (Wago, Phoenix, Weidmuller) f) Earth / Grounding: Yes, signal and power earth with Earth Bus Bar (6mm thick) and lugs. g) Incoming power: i. UPS: 110 or 240VAC-Redundant Feeder (provided during detail engineering) ii. Non-UPS: 240VAC-Single Feeder	9	Cable glands	SS / Nickel-Brass material and double compression type	10	Exhaust fans and louvers	Yes, back door / top mounted and louvers.	11	Installed Spare	20% for MCB, Power Supply, Power and Signal Terminals, Relays, Barriers etc.	12	Interposing Relays	Yes for DI & DO	13	Isolators / Barriers	Yes for AI / AO	14	Surge Protector	Yes for Power Supply and Communication
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		representatives shall inspect the system at supplier works during factory acceptance test (FAT). c) The latest certificates for use in hazardous areas shall be furnished for instruments / equipment (if applicable) by the vendor as specified below: i. Certificates from statutory authorities like BASEFA, FM, PTB, UL and LCIE etc. for items of foreign origin and from CIMFR etc. for items of Indian origin. ii. Approval certificates from CCE (Chief Controller of Explosives)/ PESO for items to be installed Hazardous area in India, irrespective of country of origin and the same is mandatory. In case CCE certificate is not available for any item at the time of offer, vendor shall confirm that the certificate shall be furnished during detailed engineering and before dispatch. iii. Approval certificate from BIS (Bureau of Indian Standards) for all flameproof instruments of Indian origin. 3. <u>VENDOR SCOPE OF WORK / SUPPLY:</u> 3.1 <u>SCOPE OF SYSTEM ENGINEERING:</u> a) The Vendor Systems Engineer (SE) shall provide the system engineering for the project to assure that the control system. b) This service includes: generation of the controller wiring drawings and control system diagrams (CSD's), the development and implementation of the control logic with Initial Controller Configuration Parameter Sets, sizing and recommendations on the control system components and system programming & testing. c) A design audit of the completed control solution shall be made before shipment. This shall be in a form of presentation by the SE to the design audit team / BHEL; which reviews all aspects of the engineered solution. d) It is mandatory to have only one set of configuration parameter for all operating conditions in the performance curves. 3.2 <u>SYSTEM ENGINEERING:</u> a) SE shall review the control system design with the customer to ensure compatibility between the control system and the application. b) Transmitters, flow measuring devices and antisurge valves associated with Antisurge control, Performance or Loadsharing Control etc. are evaluated for proper location and sizing. c) The system engineering service shall include the following for each compressor control application, but not limited to the following: i. Preparation of Design Specifications. ii. Vetting of Antisurge Valve Sizing, Suction Throttle Valve Sizing etc. iii. Number of Unique Antisurge Valves – As required iv. Number of Compressor Maps to be analyzed per Valve v. Flow Measuring Device Calculations vi. Number of Unique Flow Measurement Devices (FMD's) vii. Number of Compressor Maps to be analyzed per FMD viii. Controller Configuration. ix. Transmitter Range Specification x. Preparation of Drawings. xi. Mod Bus Address mapping list for interfacing controller with DCS xii. System / Process configuration for Performance / Loadsharing (if applicable)		
		Ref.	Doc	

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		3.3 <u>ENGINEERING MANUALS</u> a) The design and specifications shall be formally documented in the Engineering Manuals and provided in three hard copies and TWO CD/USB. This includes: - Control system diagrams - wiring and jumper list - System description - Controller / Panel dimensional drawings - Panel structural and layout drawings - A bill of materials - Controller instruction manuals - Initial controller configuration parameters (refer Note-1) b) Note-1: 'Initial Controller Configuration Parameter Sets' are calculated and prepared using project-specific data for channel assignments and functionality where possible. Gains, biases and control responses are necessarily maintained at conservative levels for safety reasons during initial start. 3.4 <u>COMMISSIONING OF THE SYSTEM</u> a) The Control system representative from the nearest location from the site shall supervise the erection, Commissioning, configuration and tuning of the controller & accessories supplied by vendor. b) The Field Engineer shall be responsible for on-site system integration and commissioning, to troubleshoot and correct any connectivity issues; and to tune the system in response to actual system dynamics. c) FSE shall optimize the overall system with respect to appropriate integration and interface with customer's DCS etc. 4. <u>SPARES PHILOSOPHY:</u> 4.1 The system shall meet the following spare philosophy. This philosophy shall be applicable for items like barriers, isolators, relays, terminals, lamps, push buttons etc. 4.2 <u>SPARES:</u> Vendor shall include following spares in their scope of supply: a) INSTALLED ENGINEERING SPARES (part of main system): Installed engineering spares shall be by 20%. The basis of offering installed engineering spares shall include: 20% spare accessories like relays, switches, lamps, fuses, circuit breakers, barriers, isolators, terminals etc. - The engineering spares shall be wired up to the field cable interface and shall be in ready-to-operate condition when field cable is connected to spare assigned terminals. - Spare pairs of the incoming cables shall be terminated on spare terminals in the marshaling / barrier cabinets as applicable. b) MANDATORY SPARES - Mandatory spares shall be ware-house spares and shall be supplied as loose items. Refer Variant table for quantity and details. - Spare modules for all types of CPU cards, IO cards, Communication cards, power supplies, termination assemblies, pre-fab cables, signal conditioners, barriers, etc.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		iii. Spare networking components like Ethernet switches, fiber optic converters, surge protection devices, patch cords, LIU etc. iv. Spare power line filters, lamps, fuses (100%) and circuit breakers, Relay, Barrier, 24V DC PS, Fan, Filter etc. c) COMMISSIONING SPARES: i. Vendor shall be responsible to supply any spares which are found necessary to replace failed modules, failed sub-systems, or corrupted / faulty software while performing pre-commissioning and commissioning activities. ii. Against commissioning spares, a complement of commissioning spares such as CPU cards, IO cards, Power supplies, Isolators, Barriers, Termination assemblies, pre-fab cables, fuses, connectors, EEPROMs and any other item deemed necessary considering that the failure of any component of the system should not delay the commissioning of the system. 5. DOCUMENTATION: a) Documentation shall be in three steps, during offer submission as response to BHEL Enquiry stage, drawing approval stage, and during delivery of items stage (as-built). b) All the documents shall be preferably in A4 size (Drawings in Auto-CAD, and documentation in A4 Size PDF) shall be used for submission. c) The documentation aesthetics shall be in line with international standards. Incomplete data, without title blocks, name of the item, document number, revision number, page number etc. will not be acceptable. d) Vendor shall be responsible for creating, making and arranging complete documentation as per BHEL requirements at all stages. e) During Technical offer submission: i. Filled up check list as per clause 15. ii. Catalogues of controller and other hardware. iii. System Architecture diagrams. iv. Communication interface diagram. v. GA & Bill of material. vi. Deviation list as per “deviation format clause 10” if any. vii. Compliance certificate (duly signed & stamped copy of complete specification). viii. Un-priced price schedule as per clause 17 with “QUOTED” against all applicable items. ix. Reference list /PTR Record (mandatory) as per clause 12 for all the items. x. Filled in Certificate of logistics support as per clause 13. f) During drawing approval after PO placement: Soft Copy of the following: i. Compressor control system description. ii. Compressor control system diagram / Architecture. iii. Antisurge control valve sizing verification / recommendation. iv. IO List / Pressure / Flow / Temperature instrument range recommendation. v. Recommendation regarding items in the antisurge loop (Piping length etc.) vi. Compressor control General arrangement, BOM and Wiring Diagram vii. MODBUS address list for serial communication viii. Quality plan & FAT Procedure. ix. Type Test & Statutory certificates. g) It is the responsibility of the vendor to review the documents for total compliance with all the BHEL specifications furnished with the inquiry before submitting to BHEL.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		h) The data sheets will be forwarded by BHEL to Customer/Consultant for approval, comments if any from Customer/Consultant shall be clarified and revise the data sheets if required by the vendor in line with BHEL / BHEL CLIENT specifications furnished with the inquiry. i) Vendor has to attend technical meeting with Customer / Consultant along with BHEL if required for technical discussions and obtaining approval of documents for the package items. j) Along with material, final documentation in THREE copies shall be sent to project site and ONE number of soft copies in CD/USB with the following listed documents. However, one advance copy shall be handed over to BHEL- Engineering for approval before dispatching multiple sets to the project site. i. Packing list. ii. All the documents submitted during drawing approval. iii. Inspection reports, iv. Photo copies of BHEL Approved documents, v. Test certificates, vi. Warrantee certificates, vii. Operation & Maintenance manuals viii. Erection and commissioning procedure. k) It is Vendors responsibility for obtaining approvals on drawings/documents from BHEL / Customer within time frame and dispatch material in time to project site office as per purchase order delivery schedule. Further vendor requests for any clarifications or approvals for delivery extensions etc. are not entertained at any stage. l) Within 15 days after commissioning: i. Final reports giving details of commissioning data, its analysis and recommendations, if any. ii. Vendor shall supply the portion of system engineering document, which requires updating as per commissioning data, and TWO copies of it shall be furnished. m) Vendor shall visit BHEL office within one week of PO/LOI to collect the project specific information (Tag no's, services, range, etc.) for engineering their drawings / documents. n) The following documents shall be provided to vendor after PO placement. Vendor to check and inform if any additional data/ document is required and specify the same in its offer. i. Compressor Datasheet (pdf format). ii. Compressor Performance Maps (pdf format). iii. Compressor Process P&ID (pdf format). iv. Compressor Suction (or discharge) Flow Element Datasheet (pdf format). v. Antisurge Control Valve Datasheet (pdf format). vi. Suction Throttle Valve Datasheet (pdf format, if applicable). vii. Performance Controller Objective / Variable (if applicable). 6. <u>GUARANTEE:</u> a) Vendor shall be responsible for all the items supplied in this package. i.e. vendor shall provide a guarantee certificate for trouble free performance of all the items for 18 months from date of supply or 12 months from the date of commissioning.		
Ref.	Doc			

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		b) If any defect in the material is reported from site the same shall be replaced by vendor at site immediately without any commercial or delivery implications. 7. <u>PACKING, MARKING & SHIPPING:</u> a) PACKING: i. All the items shall be packed in very good quality packing; the packing shall be such that the items should not be damaged during loading, unloading and transportation, the packing shall be suitable for 6 months of outdoor storage from the date of shipment. ii. The operation and maintenance manuals of all the items 3 copies shall be included in the packing. iii. One copy of the packing list shall be fixed on the packing with suitable protection to with stand loading, unloading, transportation and rain. iv. Adequate amount of silica gel or equivalent shall be provided in each box before dispatch for the removal of moisture till installation. v. All safety instructions for storage and handling shall be indicated on external surface of each box. b) PACKING LIST: i. Detailed packing list with description, quantity, tag nos, make and model no. etc. including the list of O&M manuals shall be prepared by vendor and submitted to BHEL before dispatch. ii. All the items shall be shipped in a single shipment. iii. It is the responsibility of the vendor to check that all the items are dispatched along all the accessories i.e. Cable glands, Mounting brackets, adapters etc. queries if any received from site regarding the ASC system package items shall be clarified by vendor immediately, malfunction or defects of any items reported from site within the guarantee period shall be replaced at site immediately without any commercial or delivery implications. iv. Bidder to consider and include charges for one visit to site as part of the main package as and when informed by BHEL to resolve issues if any reported from site regarding material discrepancy of the ASC system package items. c) Each device shall be identified with the following information as a minimum. i. OEM name or identity ii. Manufacturer's model and /or serial number iii. instrument range iv. Tag no. The above information shall be in a permanent form on a stainless steel nameplate and permanently attached to the device/equipment. 8. <u>ERECTION AND COMMISSIONING:</u> a) The erection of the Compressor Control System package items shall be by BHEL / Customer. However expert E&C services are required to commission the offered items and vendor to consider the supervision of E&C services in the offer. b) Pre-commissioning activities for 6 days at site and two visits inclusive of Travel, boarding, lodging, and local conveyance shall be considered. Refer Price Schedule for Details.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		c) Commissioning Assistance for 3 days at site and one visit inclusive of Travel, boarding, lodging, and local conveyance shall be considered. Refer Price Schedule for Details.																							
		9. TRAINING: The training shall offer training for configuration, operation and maintenance of the compressor control system package. The training shall be conducted at BHEL or site. All requisite training material for the said training shall be provided by the vendor during the training.																							
		10. DEVIATION FORMAT: Bidder shall submit duly filled deviation format (as given below) along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be considered for rejection. If, there are no deviations, bidder shall submit signed copy of this format, mentioning "No Deviations".																							
		<table border="1"> <thead> <tr> <th rowspan="2">Sl.No</th> <th rowspan="2">Clause No. of Spec</th> <th rowspan="2">Deviation</th> <th rowspan="2">Reason for deviation</th> <th colspan="2">Deviation category</th> </tr> <tr> <th>Product/design limitation</th> <th>Optimization</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Sl.No	Clause No. of Spec	Deviation	Reason for deviation	Deviation category		Product/design limitation	Optimization	1						2					
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1																									
2																									
		11. PROVEN TRACK RECORD: a) Bidder should have supplied & commissioned FIVE such CCS during last five years. b) At least TWO of the FIVE mentioned CCS should have been installed and used for Centrifugal Compressor train in a Petroleum Refinery (Hazardous Area) environment and each CCS shall have well proven performance record of operating satisfactorily for a minimum of 8000 running Hours. c) At least ONE of the TWO mentioned CCS should have been installed and used for TWO stage Centrifugal Compressor along with Performance Controller. d) The above criteria shall be applicable to main equipment, sub- components as well as brought out items if any. Prototype equipment / instruments or instrument under phase out cycle shall not be offered or supplied. e) Bidder shall submit necessary supporting documents / past users confirmation supporting to above PTR requirements along with technical offer. f) Bidder to furnish the PTR details as per clause 12 and the Certificate for logistics support as per clause 13 along with the offer.																							
		12. PROVEN TRACK RECORD FORMAT a) Name of the Bidder b) Whether manufacturer & supplier: c) Whether System Integrator & Supplier: d) Name of Packager:																							
		<table border="1"> <thead> <tr> <th>Sl. No.</th> <th>PTR Requirement</th> <th>Ref-1</th> <th>Ref-2</th> <th>Ref-3</th> <th>Ref-4</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Description of the items offered</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>Description of item as manufactured & Supplied/</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Sl. No.	PTR Requirement	Ref-1	Ref-2	Ref-3	Ref-4	1	Description of the items offered					2	Description of item as manufactured & Supplied/						
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Sl. No.	PTR Requirement	Ref-1	Ref-2	Ref-3	Ref-4
	engineered (identify bidder's scope of work)				
3	Purchaser's name, address, Tel no, Fax no, email and contact person				
4	Date of order placed				
5	Contractual completion date				
6	Actual completion date/ month & year of commissioning				
7	Reasons of delay if any				
8	Details of major break down till date.				

13. CERTIFICATE FOR LOGISTICS SUPPORT:
 (To be signed by Compressor Control System OEM's corporate level signatory on company letterhead and submitted along with offer)

I, on behalf of M/s _____ confirm that the Compressor Control System Model No _____ for (Antisurge / Performance / Loadsharing Control) quoted by M/s _____ for M/s <END USER> against M/s BHEL inquiry no _____ shall continue to be supported by us. The quoted Items shall not become obsolete for a minimum of TEN (10) years from the date of placement of order. The quoted item shall not be withdrawn from Indian market in next three (3) years as a matter of our corporate policy.

I further confirm that in case of placement of order by M/s BHEL on us, we shall continue to support in providing back-up engineering, maintenance support and spare part support to M/s <END USER> for a period of ten (10) years from the date of expiry of warranty.

SIGNATURE WITH SEAL
AUTHORISED, SENIOR MANAGEMENT LEVEL SIGNATORY

14. TENDER EVALUATION CRITERIA

a) The total price for the complete package i.e. **Main System, Mandatory spares, Supervision of erection & commissioning charges and training (if specified in Enquiry)** shall be considered for L1 evaluation.

b) Duly signed & stamped un-priced price schedule and unit prices shall be submitted along with technical offer by bidder as a token of concurrence that all items are quoted without which the offer will not be evaluated. For unpriced bid bidder to fill 'Quoted' for each item and submit (refer clause 17 for PRICE SCHEDULE).

15. CHECK LIST:
 (TO BE FILLED BY BIDDER AND SUBMITTED ALONG WITH OFFER)

Sl. No.	Description	Vendor Confirmation	Remarks
1	Compressor Control System with / without panel (if specified in ENQUIRY) located in the SRR and linked to its HMI (if specified in ENQUIRY) in MCR for control / engineering &		

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Sl. No.	Description	Vendor Confirmation	Remarks
	configuration purpose.		
2	Offer for complete package as per BHEL specification (for items listed in ENQUIRY). Vendors shall furnish the complete bill of material offered against the respective material codes.		
3	Offer for Mandatory spares as per BHEL specification. Vendor shall furnish the bill of material of mandatory spares offered.		
4	Clause wise confirmation / deviation to BHEL specification (as per the deviation format clause 10) included in the offer.		
5	Reference list / PTR record for compressor control system & accessories satisfying the Proven track record requirement as per clause no 12 of BHEL specification included in the offer.		
6	Certificate of logistic support as per clause no 13 of BHEL specification included in the offer for compressor control system.		
7	Filled in Unpriced Price schedule as per clause 17 is included in the technical offer.		

(Signature and stamp of bidder with date)

16. VARIANT TABLES:

a) TABLE-1: COMPRESSOR CONTROL SYSTEM-ANTISURGE CONTROL

Var No	Material Description	SAP Description	BHEL Matl Code
1	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for One Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: Not Applicable	CCS-ASC-01NO-SIMPLEX-NO PANEL	
2	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for One Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: Not Applicable	CCS-ASC-01NO-REDUND-NO PANEL	
3	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for One Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: YES	CCS-ASC-01NO-SIMPLEX-WITH PANEL	TC9765182031
4	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for One Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: YES	CCS-ASC-01NO-REDUND-WITH PANEL	TC9765182040
5	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for Two Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: Not Applicable	CCS-ASC-02NOS-SIMPLEX-NO PANEL	

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Var No	Material Description	SAP Description	BHEL Matl Code
6	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for Two Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: Not Applicable	CCS-ASC-02NOS-REDUND-NO PANEL	
7	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for Two Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: YES	CCS-ASC-02NOS-SIMPLEX-WITH PANEL	
8	<u>Compressor Control System as per following:</u> a) Application: Antisurge Control for Two Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: YES	CCS-ASC-02NOS-REDUND-WITH PANEL	

b) TABLE-2: COMPRESSOR CONTROL SYSTEM-ANTISURGE & PERFORMANCE CONTROL:

Var No	Description	SAP Description	BHEL Mat Code
11	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for One Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: Not Applicable	CCS-ASC-01NO-PERF-01NO-SIMPLX-NO PANEL	
12	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for One Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: Not Applicable	CCS-ASC-01NO-PERF-01NO-REDUND-NO PANEL	
13	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for One Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: YES	CCS-ASC-01NO-PERF-01NO-SIMPLEX & PANEL	
14	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for One Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: YES	CCS-ASC-01NO-PERF-01NO-REDUND & PANEL	
15	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for Two Stage Compressor b) Controller Hardware Redundancy: Simplex (Non-redundant) c) Panel: Not Applicable	CCS-ASC-02NOS-PERF-01NO-SIMPLX-NO PANEL	
16	<u>Compressor Control System as per following:</u> a) Application: Antisurge & Performance Control for Two Stage Compressor b) Controller Hardware Redundancy: Dual Redundant c) Panel: Not Applicable	CCS-ASC-02NOS-PERF-01NO-REDUND-NO PANEL	

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17. PRICE SCHEDULE (Refer ENQUIRY / RFQ document for applicable Quantity) Enquiry ref no. _____ Date: _____ Offer ref no. _____ Date: _____ A) Table-1: Material Supply <table border="1"> <thead> <tr> <th>Sl No</th> <th>Material Description</th> <th>Material Code</th> <th>QTY (as per RFQ)</th> <th>Unit Price</th> <th>Total Price</th> </tr> </thead> <tbody> <tr><td>1</td><td>CCS-ASC-01NO-SIMPLEX-WITH PANEL</td><td>TC9765182031</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>CCS-ASC-01NO-REDUND-WITH PANEL</td><td>TC9765182040</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>CCS-ASC-03NOS-PERF-01NO-SIMPLEX & PANEL</td><td>TC9765182210</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>HMI APP-ONE STAGE COMPRESSOR</td><td>TC9765182511</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>HMI APP-THREE STAGE COMPRESSOR</td><td>TC9765182538</td><td></td><td></td><td></td></tr> <tr><td>6</td><td>DESKTOP PC:- CCS HMI & CONFIG</td><td>TC9765182619</td><td></td><td></td><td></td></tr> <tr><td>7</td><td>DESKTOP PC COMM CABLE</td><td>TC9765182627</td><td></td><td></td><td></td></tr> <tr><td>8</td><td>ARMOURED RS485 SERIAL COMM CABLE</td><td>TC9765182635</td><td></td><td></td><td></td></tr> <tr><td>9</td><td>ARMOURED 6 CORE SINGLE MODE FO CABL ORANGE</td><td>TC9765182643</td><td></td><td></td><td></td></tr> <tr><td>10</td><td>HDPE CONDUIT ORANGE 3/4"</td><td>TC9765182651</td><td></td><td></td><td></td></tr> <tr><td>11</td><td>COMMUNICATION CARD-HMI PC</td><td>TC9765182660</td><td></td><td></td><td></td></tr> <tr><td>12</td><td>FO CONV, LIU, PATCH CORDS, PS: for HMI PC COMMUNICATION</td><td>TC9765182678</td><td></td><td></td><td></td></tr> <tr><td>13</td><td>FO CONV, LIU, PATCH CORDS, PS: for DCS COMMUNICATION</td><td>TC9765182686</td><td></td><td></td><td></td></tr> <tr><td>14</td><td>LAPTOP PC:- CCS HMI & CONFIG</td><td>TC9765182694</td><td></td><td></td><td></td></tr> <tr><td>15</td><td>CCS-ASC/PERF/LSC-SIMPLEX SPARE</td><td>TC9765182813</td><td></td><td></td><td></td></tr> <tr><td>16</td><td>CCS-ASC/PERF/LSC-REDUNDANT SPARE</td><td>TC9765182821</td><td></td><td></td><td></td></tr> <tr><td>17</td><td>CCS-PANEL SPARES</td><td>TC9765182899</td><td></td><td></td><td></td></tr> </tbody> </table>						Sl No	Material Description	Material Code	QTY (as per RFQ)	Unit Price	Total Price	1	CCS-ASC-01NO-SIMPLEX-WITH PANEL	TC9765182031				2	CCS-ASC-01NO-REDUND-WITH PANEL	TC9765182040				3	CCS-ASC-03NOS-PERF-01NO-SIMPLEX & PANEL	TC9765182210				4	HMI APP-ONE STAGE COMPRESSOR	TC9765182511				5	HMI APP-THREE STAGE COMPRESSOR	TC9765182538				6	DESKTOP PC:- CCS HMI & CONFIG	TC9765182619				7	DESKTOP PC COMM CABLE	TC9765182627				8	ARMOURED RS485 SERIAL COMM CABLE	TC9765182635				9	ARMOURED 6 CORE SINGLE MODE FO CABL ORANGE	TC9765182643				10	HDPE CONDUIT ORANGE 3/4"	TC9765182651				11	COMMUNICATION CARD-HMI PC	TC9765182660				12	FO CONV, LIU, PATCH CORDS, PS: for HMI PC COMMUNICATION	TC9765182678				13	FO CONV, LIU, PATCH CORDS, PS: for DCS COMMUNICATION	TC9765182686				14	LAPTOP PC:- CCS HMI & CONFIG	TC9765182694				15	CCS-ASC/PERF/LSC-SIMPLEX SPARE	TC9765182813				16	CCS-ASC/PERF/LSC-REDUNDANT SPARE	TC9765182821				17	CCS-PANEL SPARES	TC9765182899			
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B) Table-2: CCS-ASC Services																																							
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Notes: - a Vendor shall indicate unit price of all items of Price Schedule irrespective of RFQ Qty. - b The prices shall be valid for one year from the date of order. - c Any additional requirements which are essential for proper functioning of the control system, however not indicated in this specification shall be explicitly listed and included in the offer by vendor.																																							
VENDOR SEAL & SIGNATURE																																							
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	Rev. No.	Date	Revision Details	Revised By	Approved By
	00	04.04.2018	Issued	PRIYANKA	RAM
	Ref.				
	Doc.				