Technical Purchasing Specification Isocheck Valve for Air Blower FCC Unit

1. General

a. The supply shall consist of (1) one Isocheck Valve, to be installed at an Air Blower from a FCC Unit, with the respective pneumatic actuator, counterbalance set, control unit and any auxiliary equipments and accessories, briefly referred to as “Isocheck Valve”, to provide the necessary continuous operation during an uninterrupted campaign of 6 years.

b. Valve TAG identification: to be informed later.

c. Site of installation: to be informed later

d. Design practices shall be consistent throughout the project and special considerations shall be given to uniformity in the selection and use of materials, components and devices.

e. Construction materials shall be non-corrosive and non-combustible in a normal environments of petroleum refinery plants operating.

f. This valve must avoid the catalyst return in an eventual air supply failure due to the Air Blower problem or the unit shutdown.

g. The valve basic characteristics are given in item 18 *Data sheet* of this specification.

h. The valve process data shall be confirmed by the Air Blower Manufacturer.

i. All deviations and exceptions from this specification shall be clearly identified in the proposal and submitted for approval. Otherwise, the proposal will be considered as full acceptance of the specification. In case of any conflict, between the requirements of documents mentioned on this specification and related standards or codes, the most stringent of each requirement shall govern.

j. Compliance with this specification does not exempt Vendor/Manufacturer from the responsibility of supplying any accessory suitable for the intended service.

k. Vendor/Manufacturer shall give references of the use of his valve in Air Blower discharge line for Catalytic Cracking Unit in the petroleum industry. This reference shall include address, customer name and e-mail, plant operational conditions (fluid and operating pressure and temperature), valve characteristics (diameter, pressure rating and material) and actuating system information.

l. Vendor/Manufacturer shall guarantee that the valve and other devices is free from defects of workmanship, materials and design, during one year from the unit start-up or two years after delivery at the site plant, whichever occurs first.

m. Isocheck Valve Vendor/Manufacturer and Air Blower supplier shall freely exchange all needed information to assure compatibility of final assembly.

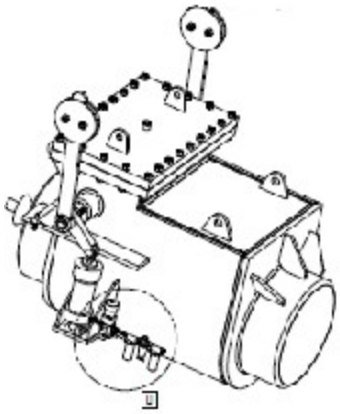
n. Recommended Manufacturers:

ATWOOD & MORRILL – USA
https://www.trilliumflow.com/product/atwood-morrill-compressor-check-valves/
IMI Z&J ZIMMERMANN & JANSEN – GERMANY
https://www.imi-critical.com/products/check-valves/
IMI REMOSA – USA
https://www.imi-critical.com/products/check-valves/

o. Applications

- Isocheck non return valve.
- Construction according to ASME B16.34 Valves - Flanged, Threaded, and Welding End
- Large diameter flanged ends in accordance with ASME B16.47 Type B.
- Service: Fluidized catalytic cracking (FCC Unit) Air Blower line check valve.
- Temperatures: normal operation 200ºC; upsets 560ºC for 50 hr/year and 705ºC one hour 2 times a year.
- Minimum lifetime: 20 years.
- Materials: Carbon steel, Chrome steel, Stainless steel according to design conditions and specification.
- Metal x metal seating: disc and seat contact areas hard faced with a Cobalt base material.
- Combination External lever with counterweight and Cylinder Actuated.
- Pneumatic actuator with spring return.
- Bolted bonnet design to allow for the maintenance without removal of the valve.
- Oil dashpot to prevent undue swinging, chattering or vibrating of the valve disc.
- Shaft for disc arm.
- Self-aligning disc and disc arm.

p. Schematic Isocheck Valve drawing



2. Vendor/Manufacturer scope

In accordance with the specifications described in the following sections of this document, the scope of Vendor/Manufacturer is:

- **a.** The sale of (1) one special check valve complete set, Isocheck Valve, comprising the valve, pneumatic actuator and control unit, to be used in the main Air Blower discharge line, to be installed at a FCCU-Fluid Catalytic Cracking Unit.
- **b.** The inspection, commissioning and start-up assistance at the site plant.
- **c.** Technical assistance and maintenance services for the Client, considering 1 (one) year from the plant start-up.
- **d.** Spare parts supplying for commissioning, start-up and (2) two years of operation.

3. Responsibilities

3.1 Vendor/Manufacturer

3.1.1. Vendor/Manufacturer shall be responsible for

- **a.** The correct design and proper operation of the Isocheck Valve;
- **b.** Compliance with the technical specification;
- **c.** Client technicians' training related to operation and maintenance activities;
- **d.** Guarantee of valve performance;
- **e.** The start-up and pre-operation of the Isocheck Valve;
- **f.** Technical assistance and maintenance services for Client during a period of 1 (one year after start-up.

3.1.2. Vendor/Manufacturer shall be responsible for all activities related to the design, manufacture and installation of the Isocheck Valve.

The extent of work shall include, but not be limited to, the following functions:

- **a.** Engineering design and specification of the Isocheck Valve;
- **b.** Engineering design and specification of the Isocheck Valve pneumatic actuator and control unit;
- **c.** Preparation of design drawings for items (a) and (b);
- **d.** Preparation and presentation of all Isocheck Valve documents for approval;
- **e.** Coordination and expediting of all purchase orders for materials and equipment related to the Isocheck Valve;
- **f.** Fabrication and assembly of Isocheck Valve according to design drawings and specifications;
- **g.** Quality control of all manufacturing work;
- **h.** Shop testing and inspection of the Isocheck Valve,
- **i.** Packing and delivery
- **j.** On-site Isocheck Valve installation.

3.1.3. Vendor/Manufacturer shall be responsible for packing the Isocheck Valve properly for maritime and road transport and delivery at site facility.

3.2 Client

Client shall be responsible to provide the following works, in accordance with Vendor/Manufacturer design documents.

- **a.** Civil engineering work.
- **b.** Power and signal cable installation between Isocheck Valve and control room.

c. All required utilities installation for Isocheck Valve.

4 Codes and standards

All work shall conform with acceptable practice for refinery and process plant installations as well as to comply with required codes and standards at the last edition.
Any conflict between specifications, recommended practices, and codes or standards shall be brought to the attention of and resolved with Manufacturer, Vendor/Manufacturer and Client.

- ANSI/FCI 70-2 American National Standard Control Valve Seat Leakage (formerly known as ASME B16.37)
- API Std 598 Valve Inspection and Testing
- API Std 615 Sound Control Mechanical Equipment for Refinery Systems
- ASME B16.5 Steel Pipe Flanges, Flanged Valves and Fittings.
- ASME B16.20 Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral-Wound, and Jacket.
- ASME B16.47 Large Diameter Steel Flanges (NPS 26 Through NPS 60)
- ASME B16.34 Valve Flanged Threaded and Welding End
- ASME B31.3 Chemical Plant and Petroleum Refinery Piping
- AWS D.1.1 Structural Welding Code - Steel.
- MSS SP-6 Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
- NEMA ICS 6 Enclosures for Industrial Control and Systems

5 Client's documents shall be considered by the Vendor/Manufacturer for quotation

- Isocheck Valve assembled drawing;
- Isocheck Valve data sheet;
- P&I FCCU Converter Piping and Instrument Diagram;
- Technical specification for design and construction of Pneumatic actuating & Control systems

6 Air Blower Isocheck Non-return Valve

6.1 Design features

a. Construction according to ASME B16.34-2004 Valves—Flanged, Threaded, and Welding End
b. Large diameter flanged ends in accordance with ASME B16.47 Type B.
c. Service: Fluidized catalytic cracking (FCC Unit) Air Blower line check valve.
d. Normal and upset temperature excursion conditions: normal operation 200ºC; upsets 560ºC for 50 hr/year and 705ºC one hour 2 times a year, with minimum lifetime of 20 years.
e. The internal clearances shall be enough to assure the operation at the emergencies or upset temperature excursion conditions.
f. The criteria to establish the design allowable stress for internals of the valve shall consider the accumulated creep damage due to the upset temperature excursions, considering the the design lifetime of the valve, 20 years or approximately 200,000 hrs, using the Larson Miller criteria and the procedure according to ASME Code Case N-47-29.
g. Internal loading: design pressure + disc differential pressure + weight of internals + differential thermal expansion between valve body and internals.
h. External loading: valve and cover weight + actuator self-weight + piping loads.
i. Recommended components: Counterbalance, Spring loaded air cylinder, Handwheel, Explosion proof three way solenoid valve and Dashpot.
j. The flanged cover shall be enough sized to permit the withdraw of the disc.
k. Materials of construction shall be according to ASTM specification.
l. Body material: ASTM A 234 Gr WCB.
m. Flanged cover: ASTM A105.
n. Disc material: ASTM A182 Gr. 304.
o. Valve shall be metal seated and design in such way to minimize leakage.
p. Seats, grooves and periphery of the disc shall be hard coated with 1,6 to 2,4 mm of E 309L according to AWS A-5.4 Classification E309 or E310, followed by a second layer of 3,0 mm Stellite Alloy No.1. All hard surface parts should be heat treated before any cutting or machining.
q. Stuffing boxes with bushings made of resilient Graphite HT- High Temperature resistant material and live loaded packing (Belleville spring).

r. Semi-metallic gasket, spiral type, spirals in AISI 304 stainless steel material, hardness 160HB max surface, with flexible graphite HT filling, centering outer ring in carbon steel, according to ASME B16.20 Standard, 1/2" @ 42" - 4.4mm thick.
s. All material shall be new and the internal and external surfaces shall be free of dirt, sand, debris and rust.
t. Vendor/Manufacturer shall provide Client with information concerning the recommended valve position, supporting points, the main dimensions, valve assembly weight and the maximum allowable loads on its connections due to piping action. Valve orientation regarding flow direction shall be clearly identified on the valve body.
u. Vendor/Manufacturer shall include all special accessories and auxiliary equipments required for installation, operation, and maintenance of the Isocheck Valve (i.e., interconnecting cables, consumable material, or calibration kits).
v. Protective guards shall be installed over sources of high temperature or voltage.
w. Any valve auxiliary connection shall be 150# pressure rating, according to the standard ASME B16.5, B16.34 and B16.47.
x. Isocheck valve shall be protected against external hazards, such as a serious accident and risk of fire or explosion, for example, when the valve could be subject to an incident of flame.
y. Isocheck valve shall be able to carry out regular operational tests, especially the Partial Stroke Test.
z. Owner shall determine frequency and nature of testing based on design and usage, a minimum of three monthly intervals is recommended.
aa. The "Partial Stroke Test" command shall be configured for a movement of at least 10% of the valve stroke, have a historical records regarding the torque and hysteresis of the maneuver, in addition to the test failure alarm.
bb. The recommendation is to adopt the "on failure remain in position" mode as a safe failure, to prevent the valve from being the initiators of the plant's failure chain, due to a spurious failure, which leads to its undue closure. It shall remain in this fail-safe position until manual reset.
cc. Isocheck valve shall be designed to operate uninterrupted, maintenance-free, for a campaign of up to 6 consecutive years once installed.

6.2 Operating features

a. The spring loaded air cylinder shall act through a lever on the valve shaft in such a way that:
- When air pressure is released from the air cylinder, the spring will exert a force through the lever tending to close the valve, but not necessarily fully closing it against the normal air flow direction.
- When air pressure is applied to the air cylinder, the spring will be compressed and there will be no force from the piston rod tending to interfere in the check valve normal swinging, except that action due to air flow passing thru.

b. The dashpot shall act to prevent undue valve swinging, chattering or vibration. It shall be provided with a by-pass between cylinder ends. The bypass shall have no constrictions except a valve, so that the valve may be closed only as much as found to be necessary in service to accomplish the purpose of the dash pot. A vent or overflow shall be provided at the top (rod) end of the cylinder to permit the rod to move downward into the cylinder avoiding movement restraint due to plunging effect.
c. The air operated check valve shall actuate with air pressure to open and spring action to close.
d. During normal operation of the air blower, the solenoids shall be energized and check valve shall be opened.
e. The interlock system implemented in DCS will give the command to deenergize the solenoids during an air blower shutdown.
f. The three-way solenoid valve will deliver air to the check valve cylinder when the solenoid coil is energized, and will vent air to atmosphere when deenergized, insuring check valve closure.
g. Solenoid valve shall be compact, without gasketing, with casing, internal part of stainless steel and rings of resilient material.
h. The connections of the casing of the solenoid valve shall be threaded ¼ - NPT.
i. The class of insulation of the coils of the solenoid valve shall be selected in accordance with the ambient temperature and the temperature of the solenoid itself.
j. Solenoid valve shall have a supply of 120 VDC.
k. The solenoid valve shall be explosion proof and in accordance with the area class criteria of the unit. Explosion proof type terminal box shall be furnished.

l. Connection with DCS shall be through the solenoid valve by a discrete signal interface.

6.3 Construction features

a. All exposed or rotating surfaces (both piston rods, slot in the air cylinder lever and the end of the shaft over which the air cylinder lever rotates) shall be protected from rain, dust, and other ambient effects by suitable sleeves.
b. The supplier shall provide suitable means of lubrication for shaft bearing, linkage bearings, pivot pins, etc.
c. The valve shall be tested in the shop to assure that it does not stick in the closed position and moves freely in all positions. The counterbalances shall be adjusted to a position in which the valve will close by gravity from any location. Means shall be provided to avoid any inadequate counterbalance assembly or disassembly.
d. The valve shall be shipped with protection to avoid any harm prior to installation. All openings shall be closed and all finished surfaces protected.
e. Valve to be installed in the horizontal position.
f. Valve shall be provided with a handwheel in order to guarantee tight shut off when necessary.

7 Actuator and Control units

a. Isocheck Valve Vendor/Manufacturer and Actuator supplier shall freely exchange all necessary information to assure compatibility of final assembly.
b. Isocheck Valve Vendor/Manufacturer shall be responsible for the supply, tests and performance of the overall assemblies.
c. Isocheck Valve Vendor/Manufacturer shall estimate the maximum operating temperature at the actuator, based on the combined effects of room temperature and thermal radiation from adjacent equipment, and provide any required heat shielding to prevent overheating of the actuator according to actuator supplier recommendations.
d. Isocheck Valve Vendor/Manufacturer shall inform all cautions which shall be taken on actuators installation, including evaluation of the available physical space, and inform actuator supplier for achieving the best installation solution.
e. The necessity of spring supports for the pneumatic actuator shall be evaluated by Vendor/Manufacturer. If additional spring supports are required, the location of the lugs, loads and the description of the supportation required shall be included on Vendor/Manufacturer drawings.
f. The actuator and accessories (filters, tubings, cables, solenoids, etc.) shall have passive fire protection, by means of painting with ablative (intumescent) paint, which meets the requirement of tolerability to the incidence of hydrocarbon flame, according to API Std 2218 and UL 1709 standards (Chapter 3 - Figure 3.1), preserving the nominal characteristics of the installations.
g. All material applied in passive protection shall have a fire resistance certificate for at least 2 hours in the case of structural items, according to UL Standard 1709 tests, and 30 minutes in the case of electrical and control cables, according to UL Standard tests 2196, using the rapid temperature rise curve (typical for hydrocarbon fire: 1100ºC) contained in Standard UL1709.
h. Power supply and control cables, from the junction box to the actuator, shall meet one of the flame resistance technical solutions, namely:
- Specification with “fireproof” according to IEC 60331 (Part 11 and Part 21), DN 1.5 x 1.5 mm, mica thermal insulation, twisted pair, with global shield and drain wire, or
- Be sent in a tray of cable beds with passive fire protection type ablative paint (intumescent) paint or ceramic blanket, suitable to withstand direct incidence of hydrocarbon flames for a minimum period of 2 hours at 1100ºC, according to API Std 2218 and UL 1709 Standards (Chapter 3 - Figure 3.1). For the protection of electrical supply and actuator control cables, passive protection is mandatory throughout its length, regardless of the route taken in its path in the process area.

8 Tagging

a. Tag numbers shall be defined by Vendor/Manufacturer according to the sequential number to be informed by the Client.
b. Air Blower Isocheck Valve: XV- ____(to be informed later).

9 Project requirements

a. The Vendor/Manufacturer shall present a complete project between actuator, valve and coupling, ensuring the perfect functioning of the set under all specified conditions, according to this specification and recommendations issued by the entities referenced in item 4 of this specification, being supplied as a single set completely assembled and ready to operate, and piping interconnections.

b. Projects shall be presented in AUTOCAD, with assembly and component detail drawings, with defined construction materials and dimensions, in Portuguese language.
All documents shall be sent in magnetic media, composing the isocheck valve's data book.

c. Functional and connection diagrams shall contain complete details of connections, terminal blocks and accessories supplied, clearly identifying the applied voltages and the functions of the components.

d. The Operation and Maintenance, Configuration and Preservation Manuals shall be provided in Portuguese language, containing all the configuration steps of their capabilities and fault and operational diagnostics.

e. Manual operation of the valve can only occur by mechanically locking the remote operation, specifically in case of maintenance.

f. Include the list of technical standards applied to the design, manufacture and tests, referring to the country of origin of the technology followed by the manufacturer, which complement the technical standards of item 4 of this specification.

g. Present the PIT-Inspection and Test Plan to be performed during manufacturing, containing at least the tests required in this specification, complemented by tests proposed by the manufacturer.

10 Shop Inspection

a. Valve inspection shall meet the requirements of API Std 598 and ASME B16.34.

b. During the Isocheck Valve fabrication and tests, inspection may be made by Client or by Client designated third part, to determine the work in progress and specification compliance.

c. After Isocheck Valve completion, Client will perform the final inspection and will supervise the tests to be done at factory.

d. Client shall be notified of factory tests, thirty days in advance.

e. Material mill test reports or certificates shall be submitted by manufacturer to Client, for the parts of body, flanges, disc, shaft, bolts/nuts, and welding consumables.

f. For the visual inspection the surfaces shall be free of scale, dirt, sand, debris and rust.

g. Dimensional and thickness inspection shall be according to manufacturer's certified approved drawing and calculation reports.

h. Non-destructive examination for cast and forged valve pieces shall comply with:

- Castings
  - Radiographic Examination

The radiographic procedures and acceptance standards to be used shall be in accordance with ASME B16.34 para. 8.3 and Appendix I.

  - Surface Examination

All exterior and all accessible interior surfaces of body, bonnet, and cover castings shall be given a surface examination with either a magnetic particle examination or a liquid penetrant examination, according to ASME B16.34 para. 8.3 and the procedure and acceptance standards of Appendix II or Appendix III, respectively.

  - Ultrasonic Examination

An ultrasonic examination of the casting in accordance with ASME B16.34 para. 8.3 may be substituted for the radiographic examination.

- Forgings, Bars, Plates, and Tubular Products
  - Ultrasonic or Radiographic Examination.

These materials shall be ultrasonically examined be in accordance with the procedure and acceptance standards in ASME B16.34 para. 8.3 and Appendix IV or radiographically examined in accordance with the procedure and acceptance standards in ASME B16.34 para. 8.3 and Appendix I

  - Surface Examination

All exterior and all accessible interior surfaces of bodies, bonnets, and covers shall be given a surface examination with either a magnetic particle examination or a liquid penetrant examination, according to ASME B16.34 para. 8.3 and the procedure and acceptance standards of Appendix II or Appendix III, respectively.

i. Non-destructive examination for welded valve pieces shall comply with:
- All fabrication welds shall receive nondestructive examination in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, in a manner that results in a weld joint efficiency of 1.0.
- All butt or grooved weld shall be submitted to radiographic test (RT) according to ASME Code Sec VIII Div. 1 UW 51.
  Where this RT is impractical, ultrasonic examination test according to ASME Code Sec. VIII Div.1 Appendix 12 shall be applied.
- Magnetic particle test (MT) or Dye penetrant test (PT), according to ASME Sec VIII Div 1 Appendix 6 and Appendix 8, shall be applied to all butt or groove welds and fillet welds. Fillet welds includes socket and seal welds, and nozzle or branch welds and reinforcements welds and “T” welds.
- The PT shall be performed for both root pass and finished weld.
- Additional examinations to be carried out on the weldments according to the Manufacturer procedures.
  - Visual and dimensional.
  - Thickness measurement.
  - Tightness test.
  - Hardness measurement.

j. The dissimilar welding between Carbon steel x stainless steel parts, shall follow the API Recommended Practice 582 "Welding Guide-lines for the chemical oil, and gas industries”, that provides the necessary informations on the selection of the filler metal based on the design temperature for dissimilar welding.

k. Vendor/Manufacturer shall analyze the necessity of performing a PWHT-Post Weld Heat Treatment, to prevent distortions at operating and emergency temperatures.
If the Isocheck valve has to be heat treated, the conditions shall be in accordance with the postweld heat treatment requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. A safe PWHT procedure shall be used to prevent cracks in the dissimilar welds, if any, and the examination by radiography or ultrasonic methods shall be executed after postweld heat treatment.

l. The checkout and testing shall include, as a minimum, the following:
- Visual inspection of all work to assure mechanical completeness and compliance with all design drawings and specifications.
- Visual inspection of nameplate and tag to verify correct identification.
- Valve seat leakage test.
- Point-to-point check of all wiring and tubing to verify proper interconnection.
- Continuity and Isocheck test of all electrical wiring.
- Pressure test of all piping and tubing.
- Functional test of all electrical and pneumatic devices to verify proper operation and input/output signals where applicable.
- Functional and calibration test of all instrumentation.
- Functional and calibration test of actuator.
- Functional test of pneumatic actuator unit and control unit.
- Other tests agreed between Client and Isocheck Valve Vendor/Manufacturer.

11 Tests

a. Valve shall be submitted to pressure tests according to API Std 598, Table 1.

b. Valve shall be submitted to the low pressure closure test and high pressure closure test as defined in API Std 598, with air or inert gas.

c. Acceptance criteria: API Std. 598 Table 5 (metal seated check valve) rates shall be considered.

d. Valve body shall be pressure tested in accordance with requirements of API Std. 598.
If hydrotest is to be performed, only clean potable water with chloride content according to Client standard shall be used. As a minimum, water with chloride content not exceeding 50 ppm shall be used, and valve Manufacturer shall be able to document the chloride content.
Test pressure shall be maintained for a minimum of one hour per 25 mm thickness of thickest retaining part with a minimum of 30 minutes. Welding on valve is not permitted after pressure test.
Visually detectable leakage through the pressure walls and any fixed body joint is not permitted.

e. The pneumatic systems shall be fully tested for all functions.
f. A complete pneumatic system pressure test shall be done using hydraulic oil 1.5 times the maximum operating pressure for 15 minutes.
g. All testing and inspecting procedures and results shall be documented and supplied to the inspector.
h. Plant Acceptance Test is a repetition of the Factory Acceptance Tests verifying the Isocheck Valve operability and fixing possible damages occurred during the transportation, delivery, installation at the site and integration with DCS.

12 Shipment

The Isocheck valve shall be prepared and shipped to the jobsite, with the following minimum protection measures:

a. Liquids shall be drained and lines cleaned.
b. All external connections shall be capped or plugged to prevent entrance of extraneous material.
c. Fragile or sensitive equipment and components shall be removed and packed separately.
d. All movable parts shall be secured or supported with shipping braces to prevent damage from vibration.
e. All loose equipment shall be packed in shipping crates or cartons suitable for maritime shipment.
f. Isocheck valve itself shall be packed and suitable for maritime shipment.

13 Spare parts

a. Vendor/Manufacturer shall submit a separate quotation on recommended spare parts, for commissioning and for three (3) years operation, for all Isocheck Valve devices and accessories.
b. Spare parts shall be delivered clearly identified with name and part number.
c. The proposals shall list spare parts in detail, with name, part number and prices.

14 Services specification

a. The technical services shall be developed and executed by Vendor/Nanufacturer to facilitate the installation, start-up and operation of the Isocheck Valve.
b. Scope of field services shall include, at least:
- Isocheck Valve inspection at site.
- Pneumatic lines inspection.
- Electric signal lines inspection.

c. Prestart-up, calibration and test shall include, at least :
- Field work management of tubing, wiring and accessories connection to Isocheck Valve.
- Functional inspection of valve, actuators, control unit and all devices.
- Calibration and operation of actuator to assure performance guarantees.
- All instrumentation signal transmission validation.
- Solenoids input signal transmission validation.

d. Start-up shall include, at least:
- Isocheck Valve operation stability supervision for final acceptance.

e. Local training for operation and maintenance staff shall include, at least:
- Training program organization and application.
- Classroom instructions, concerning valve operation, actuator and control unit calibration and valve and all devices maintenance.
- Practical training during Isocheck Valve calibration and testing.

f. Vendor/Manufacturer shall execute a routine inspection program during the first year of operation and shall be prepared to assist Client for emergency maintenance services in a schedule time of 1 day from the official convocation.

15 Engineering documents

Vendor/Manufacturer shall issue, at least, the following drawings and/or documents.

a. Designing
- Data Sheet of valve, pneumatic actuator, control unit, all instrumentation, auxiliary systems, valve, filters, and other parts which compose the Isocheck Valve;
- Name Plate drawings with the dimensional and color specifications;

- Isocheck Valve Schematic Drawing presenting the devices functions with components identification;
- Isocheck Valve details, comprising:
  - Cross section drawing of the valve;
  - Outline drawing with valve and pneumatic actuators dimensions and weights, parts list of both, specification of all gaskets and packing;
  - Body, closure member and shaft material certificates;
  - Certificate test and compliance with API Std 598;
  - Location of weld repair in pressure containing cast parts;
  - Location of all field connections, and the necessary information to installation;
  - Point to point wiring diagrams, connection details and location of electric signal interface;
  - Pneumatic tubing interconnection diagrams with utilities identification and lines dimensions;
  - Isocheck Valve weight, including its actuator;
  - Allowable forces and moments on the valve ports;
  - Spring support (if required for the valve) location of the lugs, loads and the schema of the supportation required.
- Calculation report of valve components and the coupling with the pneumatic actuator.
- Electric Signal Wiring and Grounding Diagrams for each valve signal interface, cable specifications, terminal box identification, and area classification;
- Basic Design Criteria comprising at least the following information:
  - Instrument air supply system requirements;
  - Electrical System requirements;
  - Grounding System requirements;
  - Electrical installation requirements and instructions.
- Verification Criteria including the measurement points and the outline values to be checked by the time of Commissioning, in order to verify if the Basic Criteria of the Project is attended.
- Painting procedure.
- Material mill certificates.

b. Didactic Material

- Vendor/Manufacturer shall provide training manuals, postscripts and all documents which integrate the training courses documentation, with copies to each trainee. One additional copy of this documentation shall be previously issued to Client for appreciation.
  Note: The training manuals shall be presented in Portuguese language.

c. Special Technical Documents

- Tests Procedures for factory inspection, indicating the reference documents.
- Tests Reports executed during the factory inspection including all events, actions or solutions adopted.
- Plant Acceptance Test Procedures indicating the reference documents.
- Plant Acceptance Test Reports including all events, actions or solutions adopted.
- Transport Procedure and Cautions.
- Description of special cautions that must be adopted, in case of equipment temporary storage at Client, before definitive installation.
- Instrument calibration certifications.

d. Isocheck Valve Maintenance and Operation Instruction Manuals, including at least:

- Detailed repair, installation and maintenance procedure for valve, actuator and control unit;
- Detailed procedure for valve adjustment, dismantling and assembly;
- Procedure for lubrication;
- Valve critical internal dimensions and tolerances;
- Weld repair procedure for body and closure member;
- Pneumatic actuator technical features;
- Pneumatic system schematic diagrams;
- Part number lists.
- Online and offline diagnostic/testing procedures;
- Devices wiring;
- Power and instrumentation electric diagrams;

- Drawings with material identification and part numbers of mechanical items.

e. Maintenance Manual shall also include at least:
- All the diagrams and electric scheme with part number indication and all components commercial designation, procedures and routines for preventive maintenance, inspection with an indication of the frequency, corrective maintenance, calibration, and tests for all associated devices.
- A list of all necessary equipment, kits and special tools for mechanical and electrical maintenance.
- Services information which:
  - Can not be executed by Client technicians;
  - Shall be executed by others;
  - Shall be executed by the manufacturer at the factory;
  - Shall be executed by the manufacturer at the plant.

f. Vendor/Manufacturer shall send three CD copies with all the drawings, data sheets and manuals in electronic files included. The manuals shall be sent in hardcopy as well (three copies each).

16 Technical proposal

The Technical Proposal shall be structured in chapters in which shall be shown, at least, the following information, for the isocheck valve:
- Drawing containing all Isocheck Valve devices and components and their functions.
- General description of proposed Isocheck Valve.
- Valve: resources, functions and components.
- Pneumatic Actuator: resources, functions and components.
- Control Unit: resources, functions and components.
- Inspection, exams and tests at Vendor/Manufacturer's shop.
- Inspection and tests at installation site.
- Description of the training program for Engineering, Operation and Maintenance of the Isocheck Valve, to be held at installation site.
- Duration of each category of training.
- Names, locations, phone and e-mail numbers for three references with according to this specification.

17 Commercial proposal

a. The Commercial Proposal shall present the unitary and total prices, for each valve, according to the following instructions:
- Isocheck valve global price, including all services.
- Isocheck valve price
- Pneumatic Actuator price.
- Control Unit price.
- Accessories detailed prices.
- Spare parts detailed prices.
- Services prices at the site of installation.
- Isocheck Valve Commissioning and Start-up, distinguishing the number of days.
- Training, distinguishing the number of days.
- Assisted Operation, considering 30 (thirty) days.
- Technical assistance and maintenance services, considering 1 (one) year from the plant startup.

b. It shall be informed in the Commercial Proposal that the substitution of any component, part, subsystem or equipment is a Vendor/Manufacturer responsibility until the end of the assisted operation.

c. The Commercial Proposal shall present the Isocheck Valve guarantee conditions, according to this specification.

d. The Commercial Proposal shall present the payment conditions.

e. It is desirable that Local Service be available, and Vendor/Manufacturer shall describe the support services available in Brazil for the proposed system.

18 Data sheet

A typical Isocheck Valve data sheet is presented on the next pages.

PURPOSE	Prevent return flow from regenerator vessel
QUANTITY	1 (one)
TAG	XV- (note 1)
NOMINAL DIAMETER	
LINE IDENTIFICATION	
TYPE OF VALVE	Check valve with closing handwheel and penumatic actuat

OPERATIONAL CONDITIONS (note 2)				
CONDITION	Normal	Maximum	Minimum	Eventual
FLUID	Air			
PHYSICAL STATE	Gas			
TEMPERATURE (^{O}C)				(note 3)
UPSTREAM PRESSURE (Kgf/cm^{2}g)				
DOWNSTREAM PRESSURE (Kgf/cm^{2}g)				
OPERATING FREQUENCY	-	-	-	
CAPACITY (Kg/h)				
DENSITY IN OPER. (Kg/M^3)				
VISCOSITY IN OPER. (cP)				
VAPOR PHASE				
CAPACITY (Kg/h)				
MOLECULAR WEIGHT				
Cp/Cv				
Compressibility Factor				

DESIGN CONDITIONS (note 2)	
TEMPERATURE (^{O}C)	
PRESSURE GAUGE (Kgf/cm^2)	

AIR SUPPLY (note 4)				
INSTRUMENT AIR				
CONDITION	Normal	Maximum	Minimum	Eventual
PRESSURE GAUGE (Kgf/cm^2)				
TEMPERATURE (^{O}C)				
PLANT AIR				
PRESSURE GAUGE (Kgf/cm^2)				-
TEMPERATURE (^{O}C)				-

CONSTRUCTION	
END CONNECTIONS	FLANGES, 150#, RAISED FACE, ASME B16.47, serie B
FLANGE FACE	According to ASME B16.47
BODY	ASTM A234 Gr. WCB
CLOSURE MEMBER MATERIAL	ASTM A182 Gr.F304
CLOSURE MEMBER COATING	By Manufacturer
SEAT MATERIAL	By Manufacturer
SEAT COATING	By Manufacturer
DIMENSIONAL STANDARD	By Manufacturer

TEST STANDARD	API 598			
LEAKAGE CLASS	According to API 598			
ACTUATION	X	MANUAL	X	GEAR
		MOTOR	X	Pneumatic actuator
OPENING TIME	-			
PACKING	By Manufacturer			
PORT OPENING	-			
INSTALLATION	Without roof			
ATM. PRESSURE (Kgf/cm²)	(note 2)			
ROOM TEMPERATURE (°C)	(note 2)			

Notes:

1. The Tag number will be informed later by Client.
2. Operational and design conditions will be informed later by Client.
3. Eventual or upset temperature excursion conditions: Temperatures: normal operation 200ºC; upsets 560ºC for 50 hr/year and 705ºC one hour 2 times a year.
   Minimum lifetime: 20 years.
   The internal clearances shall be enough to assure the operation at the emergencies or upset temperature excursion conditions.
4. To be informed by Vendor/Manufacturer.