Technical and purchasing specifications for Hydraulic Linear Actuator and Electrohydraulic Power and Control Units for Coker Top and Bottom Unheading and Reheading Valve Systems

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1. Purpose

This specification sets forth the minimum requirements for the design, fabrication, inspection, testing and supply of the actuating system for the remotely operated fully automated unheading and reheading valves, here named SYSTEM, to be installed at the top and the bottom of each Coke Drum, from a Delayed Coking Unit.

The SYSTEM shall be complete with quick opening and closing top and bottom unheading and reheading valves, respective actuators, HPU-Hydraulic Power Unit, HCU-Hydraulic Control Units, LPC-Local Panel Control and the facilities to interconnect with the DCS system of the Plant.
The HPU shall attend all the Coke Drums of the same Delayed Coking Unit and HCU shall be proper of each Coke Drum.

Two double-acting linear electrohydraulic cylinder actuators, titular and for emergency with 100% of redundancy; position indicator; locking/lockout system; pneumatic motor driven mechanical back-up system and a HPCU - High Pressure and Control Unit comprising:
a- One hydraulic power and control unit (HPU+HCU) for the set of valves, completely assembled and skid mounted.
b- Hydraulic manifolds for connecting each valve to the HPCU.
c- Local Panel Control (LPC) common for the set of valves with a cabinet.
d- Facilities for interconnecting to DCS.

Electrohydraulic linear actuator design conditions	Design differential pressure kgf/cm²	Force kgf
Thrust for closing	Atmospheric pressure	By Vendor/Manufacturer
Thrust for opening	3.0	By Vendor/Manufacturer
Actuator weight	By Vendor/Manufacturer	By Vendor/Manufacturer
Area classification	Powder and explosion proof Class 1 Zone 1 Group IIA/IIB T3	

Notes:

1- The actuator power shall be able to crush and beak coke rocks of 875 kgf/m³ density.
2- The 1.5 min safety factor shall be taken over the design required thrust for opening condition.
3- Class I-Locations in which flammable gases or vapors may or may not be in sufficient quantities to produce explosive or ignitable mixtures.
Zone 1—Ignitable concentrations of flammable gases or vapors which are likely to occur under normal operating conditions.
Group IIA—Atmospheres containing propane, or gases and vapors of equivalent hazard.
Group IIB—Atmospheres containing ethylene, or gases and vapors of equivalent hazard.
T3 means that its maximum surface temperature will not exceed 200C.

Temperature classes	Ignition temperature range of the mixture	Permissible surface temperature of the electrical equipment
T1	> 450 °C	450 °C
T2	> 300 °C ... ≤ 450 °C	300 °C
T3	> 200 °C ... ≤ 300 °C	200 °C
T4	> 135 °C ... ≤ 200 °C	135 °C
T5	> 100 °C ... ≤ 135 °C	100 °C
T6	> 85 °C ... ≤ 100 °C	85 °C

Based on Client's experience in operating Delayed Coking Units is presented an operational sequence for the SYSTEM, but the Vendor/Manufacturer is encouraged to propose improvements for operation, reliability and safety.

2. Hydraulic Power Unit (HPU) and Hydraulic Control Unit (HCU)

2.1 Vendor/Manufacturer shall forecast on SYSTEM interlock logic, an operation inhibition signal from DCS to avoid undesirable action on SYSTEM local control panel during Coke Drum operation modes conditions not equal to “DECOKING MODE”. This signal shall be supplied by hardwire from DCS located at the Unit control room.
2.2 SYSTEM main alarms associated to interlock events shall be supplied to DCS for operability information.
2.3 The HPU-Hydraulic Power Unit, along with each HCU-Hydraulic Control Unit, from SYSTEM, shall be designed to provide remote control of the HPU and selection of the desired Coke Drum for unheading. The HCU shall also provide an active Coke Drum status, hydraulic pump status and alarm status for the HPU.
One HPU shall be common to all the Coke Drums and one HCU for each Coke Drum.
The functions shall be controlled from the panel by joystick handle type spool valves.
Controls for each unheading device shall be arranged together, if possible, to facilitate-operation in a sequential manner.
2.4 The HPU shall be delivered completely pre-assembled and skid mounted, with bulkhead tubing connections, flanged piping connections and electrical and control wiring terminated in separate NEMA 4X-stainless steel junction boxes at edge of skid.
2.5 The HPU shall include two (2) 100% capacity, electrically driven, rotary or pressure compensated variable displacement pumps, arranged for mutual sparing. They shall be installed on a common HPU skid, operating from a common hydraulic reservoir. The HPU skid shall be capable of powering normal operations of the top and bottom unheading systems of the selected Coke Drum. The HPU skid frame shall be fabricated from stainless steel structural shapes and sheet without any painting.
2.6 The main hydraulic pump shall be furnished with Vendor/Manufacturer standard horsepower limiter to match flow and pressure to load demand. When the Vendor/Manufacturer-set power setting is reached, the control system shall automatically reduce fluid delivery as the circuit pressure rises.
2.7 Each hydraulic pump shall be isolated on the suction side by a Vendor/Manufacturer-standard isolation valve, and on the discharge side by means of a line check valve. Under normal conditions, pumps shall operate alternately.
2.8 For vibration isolation in the piping system, the Vendor/Manufacturer may use flexible hoses on the pump suction and discharge lines. Flexible hoses shall be Titeflex type R160, special high pressure construction, or Client approved equal, and shall be furnished with external stainless steel braids and stainless steel fittings.
Hoses shall be rated for a minimum working pressure recommended by the hose manufacturer for the intended application but, in no case, shall be less than 210 kg/cm² (3,000 psi) at 205°C (400°F). Hose lengths shall be kept to a minimum. Each hose assembly shall be adequately supported and/or restrained to avoid any interference with the operation of any controls and operator movements, and shall not cause any hazardous condition in general.
2.9 The Vendor/Manufacturer shall size the hydraulic oil reservoir to ensure adequate capacity to fill all piping, tubings, hoses and devices requiring hydraulic oil and to provide for residual oil for cooling.
The minimum hydraulic oil reservoir storage capacity shall be determined by the Vendor/Manufacturer but shall not be less than 200 US gallons. The reservoir shall be AISI 316L stainless steel tank and shall have a bottom sloped toward the drain nozzle. The reservoir shall be equipped with breather type fill cap, high pressure discharge filters, pump suction filters, all control and operating valves, an external level gauge, a low level alarm switch/transmitter, a high temperature alarm switch/transmitter, high and a low pressure alarm switches/transmitters, a manual drain valve with an end cap or a plug, an external relief valve for each pump with a relieve back to the reservoir, and all piping/tubings/fittings/supports. The reservoir shall be provided with separate connections for fill, inlet filter, level indicator, drain, clean-out, pump suction lines, low level alarm switch, high temperature alarm switch, breathers’ tailpipes from the two pump relief valves, and pump bypass line.
The Vendor/Manufacturer shall supply an immersion oil heater for winterization.
2.10 The Vendor/Manufacturer shall furnish a 5-micron pressure filter in each pressure line and a 50-micron return line filter, selected per Vendor/Manufacturer standard practices, in the common return line. Filters shall be constructed per ASME Code. Filters shall be placed in an accessible location for easy replacement without the use of ladders, scaffolding or removal other HPU skid elements.
Vendor/Manufacturer shall furnish a dual electrical/visual pressure indicator with a differential pressure switch across each filter.
2.11 All valves and gauges in the high pressure lines shall be furnished with block-and-bleed type valve assemblies.

2.12 Client shall propose the location the HPU and control panels.
2.13 Hydraulic system shall utilize fire resistant oil, such as Fyrquel 220 MLT or Vendor/Manufacturer recommended equal. Glycol based oils are unacceptable. Client shall agree to the final hydraulic oil selection in writing. Hydraulic fluid should not be of a special type and should be easily encountered in the Brazilian market, and Client prefers to use Brazilian products.
2.14 ESD hydraulic solenoid Valves
Solenoid valves for emergency shutdown services shall be provided and shall trip the valve when de-energized. Solenoid valves shall be “poppet” type. Spool type solenoids are not acceptable for hydraulic fluid service.
The solenoids shall be fail safe type and shall be powered and reset from process PES-Programmable Electronic System.
.2.15 Manual Hydraulic Operation:
A manually operated 3-position valve (open-auto-close) shall be provided to hydraulically position the actuator (to be used in case of solenoid valve failure)
2.16 Cooling System:
An air cooling system (forced air type) shall be provided for the stem.
Cooling system design shall take into consideration environmental conditions (temperature, thermal radiation etc).
2.17 Filters
A differential pressure indicator and alarm shall be supplied across the filter.
2.18 The supply shall standardize the installations, supplying materials and equipments of the same class and specialty of the same Vendor, in order to reduce the quantity and necessity of spare parts and rationalize the maintenance. Materials and instruments of the same type shall obligatorily be of the same Vendor.
Equipments, instruments and materials suppliers shall have their selling offices and technical assistance in Brazil.
2.19 Maintenance, commissioning and start-up manuals shall be in Portuguese language.

3. Unheading system branch manifolds

3.1 The Vendor/Manufacturer shall furnish discharge branch manifolds, installed downstream of the pressure filters. There must be two discharge manifold for each two Coke Drums: one for top valves and the other for bottom valves.
Each discharge manifold shall be furnished with the following:
a) Minimum two (2) solenoid-operated line block valves to isolate pump pressure from the unheading directional control valve until all system permissives are satisfied and lock-out pin is removed for the selected Coke Drum.
b) Minimum two (2) solenoid actuated directional control valves to control the direction of movement of the unheading valve actuator.
c) Minimum two (2) manual shutoff valve to isolate the manifold from valve stack, when closed, from the tubing runs when maintenance is to be performed.
3.2 Types of isolation valves shall be per Vendor/Manufacturer design practices.
3.3 Vendor/Manufacturer shall furnish a return line branch manifold, installed upstream of the common return line filter, check valves and discharge branch isolation valves. The check valve and isolation valve(s) shall isolate an operating circuit from non-operating circuits.
3.4 Branch manifolds shall be installed inside a NEMA 4X stainless steel enclosure with bulkhead unions for field tubing terminations. Tubing shall be installed so that all hydraulic porting from the hydraulic manifold shall be terminated internally at bulkhead unions on the sides and bottom of the enclosure. To accommodate connections to field installed piping, the Vendor/Manufacturer shall furnish weld neck connector adapters for conversion to SAE straight threads with the manifold enclosures.
3.5 Directional valves shall be close centered, solenoid-operated type.
3.6 The Vendor/Manufacturer shall furnish pressure gauges to be mounted externally to each side of the hydraulic manifold enclosure. As a minimum, the pressure gauges shall indicate:
a) Manifold pressure on the upstream side of the directional control valve to indicate true manifold through pressure.
b) “Valve Open” pressure on the downstream side of the directional control valve.
c) “Valve Close” pressure on the downstream side of the directional control valve.

4. Hydraulic cylinders

4.1 All hydraulic cylinders shall be double acting, similar to Vickers high pressure Type TG or of Client approved equal.
4.2 Cylinder rods shall be polished 17-4 PH stainless steel or of Vendor/Manufacturer standard construction and shall be specifically designed for extremely rugged coker application. Minimum pressure rating of the cylinders shall be per Vendor/Manufacturer standard design practice. Exposed rod extensions shall be protected with bellows type sleeves suitable for the intended application.
4.3 Cylinders shall be compatible with the Vendor/Manufacturer recommended hydraulic oil.
4.4 The Vendor/Manufacturer shall provide proximity switches to indicate “Valve Open” and “Valve Closed” positions.
Additionally, the Vendor/Manufacturer shall furnish two lockout lower proximity switches per cylinder for mounting on the unheading valve.
4.5 Stainless steel ball fire tested valves shall be provided to isolate each cylinder mounted hydraulic hose.
4.6 Hydraulic Reservoir shall be provided with thermometer, thermocouple, level gauge and level transmitter.
4.7 Reservoir shall be sized to include enough capacity for 2 times all accumulators, cylinders, manifolds and piping operated from the pump system.

5. Piping/tubing/hoses/fittings
5.1 All tubings shall be fully annealed, seamless AISI 316 stainless steel hydraulic tubings per ASTM A-269 or A-213. Material hardness shall be 85 Rb or less. Minimum tubing outside diameter shall be 13 mm (nominal ½”). All tubings shall be free of scratches. Tubing ends shall be smooth and free from burrs. Tubings shall be suitable for bending and flaring.
5.2 When pipe is used in lieu of tubing in the field installation, the Vendor/Manufacturer shall install SAE Code 62 flanges per SAE Standard J518 for the field connections to the HPU skid pressure and return line manifolds.
5.3 Where Vendor/Manufacturer uses O-rings in lieu of gaskets, SAE weld neck flange may be used in lieu of ASME flanges. O-rings shall be Viton.
5.4 Tubing connections shall be furnished with bulkheads while pipe connections shall be furnished with RF flanges.
5.5 Fittings for tubings shall be AISI 316 stainless steel Swagelok brand.
5.6 All ball valves shall have a stainless steel trim, stainless steel bodies and high temperature seats and fire safe design. They shall be supplied with hardware to secure them in the open or closed position.
5.7 Fittings for hydraulic cylinders, control valves and other hydraulic components shall be Swagelok brand. They shall be furnished with SAE straight thread O-ring seals. O-rings shall be Viton.
5.8 All piping and tubing within the confines of each equipment item shall be shop assembled with Client’s hook-up connections at the edge of the skid.
5.9 Cylinder-mounted flexible hydraulic hoses shall be high temperature, fireproof, with stainless steel outer reinforcement sheathing. They shall be rated for a minimum working pressure recommended by the hose manufacturer for the given application but, in no case, shall be less than 210 kg/cm² (3,000 psi) at 205°C (400°F).

6. Electrical and Controls
6.1 Motors
6.1.1 Vendor/Manufacturer shall furnish AC squirrel cage per the Project Specification.
6.1.2 All motors, except for gearmotors, shall be connected to their respective driven machinery by heavy-duty non-lubricated stainless steel flexible disk couplings.
6.1.3 Motors shall be insulated to protect against tropical environment, fumes, dust and fungus. All external hardware for the motors shall be of stainless steel construction.

6.2 General Electrical and Control Requirements
6.2.1 Electrical system shall be in furnished in accordance with the Client’s Project Electrical Specifications for motors, electrical devices, and other related electrical requirements.
6.2.2 All electrical wiring shall be terminated to a stainless steel junction box provided by Vendor/Manufacturer at the edge of the equipment skid.
6.2.3 Solenoid coils shall be designed for 120 VAC power. Electric solenoids shall be designed for no voltage release, that is, the solenoid moves to the safest operating position when deenergized.

6.2.4 All electrical and control equipment shall meet the electrical area classification specified in the Project Specifications.
6.2.5 The Vendor/Manufacturer shall provide earth bosses/grounding clips for all equipment and structure. Client will provide the grounding loop and the grounding tie-ins.
6.2.6 All electrical and control devices, instruments, etc., shall be suitable the specified electrical area classification: powder and explosion proof Class 1 Zone 1 Group IIA/IIB T3.
6.2.7 Power for all the Electronic Panels (PLC) will be supplied by Client using uninterruptible power supply system at 120 VDC UPS-Uninterruptible Power Supplies.
120 VAC will supplied for socket and lightning.
6.2 8 The 24 VDC power supplies for field instruments in the Control Panel shall be QUINT model, from PHOENIX CONTACT.

6.3 Wiring
6.3.1 All wiring shall be in accordance with latest edition of the National Electric Code.
Wiring will run in rigid metal conduit. Flexible metal conduits, used for motors and devices, shall be UL approved and no longer than 30-inches.
6.3.2 Interconnecting wiring shall be terminated using ring-lugs and suitable terminal boards.
6.3.3 No wire splices shall be permitted, except for motors that are normally furnished with leads for connections. Wires shall be continuous between devices.
6.3.4 Except for temporary wiring, megger tests shall be conducted before termination of all wires.
6.3.5 All fasteners, conduits, conduits fittings, clamps, and the likes shall be either hot dipped galvanized or stainless steel.
Zinc, cadmium or other plated fasteners, conduits, conduits fittings clamps, etc., are unacceptable.

6.4 General Controls & Instrumentation Requirements
6.4.1 The top and bottom unheading devices shall be controlled from Client furnished distributed control system (DCS) and safety instrumented system (SIS) in conjunction with a Vendor/Manufacturer furnished hydraulic control system. All instruments and controls, and control wiring shall comply with the Client's Project Specifications.
6.4.2 Control system shall be in furnished in accordance with the Project Control System Specifications for control devices, control wiring and other related control and instrumentation requirements.

6.5 Local Control Panel
6.5.1 The local control panel shall be certified according to the area classification of the Unit, where IEC Ex-p grade, with purge air, is required.
6.5.2 Local panel shall also incorporate protections against rain and dust exposure according to IEC IP-65 grade, at least. NEMA 4X stainless steel.
6.5.3 All alarms/shutdown indications, auxiliary and monitoring systems variables shall be available on the local panel, through a flat panel VGA display according to the items below:

- Full useful display area of 12" size at least;
- Panel View for operation display (screen selection, paging, etc) with a suitable keyboard pad. The display shall allow easy screen reading in daylight conditions;
- Vendor/Manufacturer shall supply the required hardware, devices and procedures for the display configuration.

6.5.4 Communications control and interlock signals with DCS
Vendor/Manufacturer shall provide the local panel equipment with RS-485/MODBUS-RTU or MODBUS-TPC or a similar protocol for communication with DCS, defined by the Client. This communication interface shall enable the local panel to relay all equipment information (process variables, monitoring systems status, alarms, shutdowns, etc) to the DCS. The interface shall also enable remote equipment operation from the DCS. Vendor/Manufacturer shall give support to the Client for communication set-up and all necessary configurations.
Vendor/Manufacturer shall also provide the local panel equipment with an Ethernet Port for communication with Plant configuration and maintenance industrial network.
All the instruments necessary to the valves control system shall be powered by the internal power source of the Control Panel itself.
6.5.5 Alarms
Hydraulic System Trouble Alarms that shall be configured at local panel shall include:

- Low pressure at pumps discharge
- Low level at reservoir

- High temperature of hydraulic oil
- High differential pressure at filters
- Low pressure at accumulators

6.6 Top Unheading Control Panel

6.6.1 Top unheading control panel shall be designed to provide local status and control of all Coke Drums.
It will be installed by the Client a safe distance from the Coke Drums for operator safety.
6.6.2 Panel enclosure shall be NEMA 4X, stainless steel.
6.6.3 Panel base shall be mounted six inches (6") above the cutting deck to allow coke dust buildup to be blown out. Panel shall be mounted and braced to preclude excessive vibration during operation
6.6.4 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following status indications for each Coke Drum on the panel face:

a) Pump running
b) Drum selected
c) DCS permissive
d) Valve locked open
e) Valve locked closed
f) Valve open
g) Valve closed.

6.6.5 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following pushbuttons/selector switches for each Coke Drum on the panel face:

a) Lamp test
b) Pump stop
c) Drum select
d) Valve open
e) Valve closed
f) Valve stop.

6.6.6 All control information shall be available through the Client furnished DCS and SIS, as applicable.
6.6.7 Pushbuttons and selector switches shall be hermetically sealed.
6.6.8 The Vendor/Manufacturer shall furnish purge connection to maintain a positive pressure inside the panel to prevent ingress of coke dust. Purge gas will be furnished by the Client.
6.6.9 The Vendor/Manufacturer shall furnish dust seal and dust seal cover to prevent coke dust from settling on the lamps, switches and other devices.

6.7 Bottom Unheading Control Panel

6.7.1 Bottom unheading control panel shall be designed to provide local status and control of all Coke Drums.
It will be installed by the Client a safe distance from the Coke Drums for operator safety.
6.7.2 Panel enclosure shall be NEMA 4X, stainless steel.
6.7.3 Panel base shall be mounted six inches (6") above the cutting deck to allow coke dust buildup to be blown out. Panel shall be mounted and braced to preclude excessive vibration during operation
6.7.4 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following status indications for each Coke Drum on the panel face:

a) Pump running
b) Drum selected
c) DCS permissive
d) Top unheading valve open
e) Valve locked open
f) Valve locked closed
g) Valve open
h) Valve closed.

6.7.5 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following pushbuttons/selector switches for each Coke Drum on the panel face:

a) Lamp test
b) Pump stop
c) Drum select
d) Valve open
e) Valve closed

f) Valve stop.

6.7.6 All control information shall be available through the Client furnished DCS and SIS, as applicable.

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6.7.9 The Vendor/Manufacturer shall furnish dust seal and dust seal cover to prevent coke dust from settling on the lamps, switches and other devices.

6.8 Informations to be indicated in each Local Control Panel

6.8.1 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following status indications on the panel face:

a) Pump No. A running
b) Pump No. B running
c) DCS permissive
d) Oil reservoir heater on.

6.8.2 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following pushbuttons/selector switches on the panel face:

a) Lamp test
b) Reset
c) Pump A start
d) Pump A stop
e) Pump B start
f) Pump B stop
g) Local control panel selection.

6.8.3 As a minimum, but not be limited to, the Vendor/Manufacturer shall furnish the following alarm status indication on the panel face:

a) Oil reservoir heater failure
b) Oil reservoir low temperature
c) Oil reservoir low low temperature
d) Oil reservoir high temperature
e) Oil reservoir high high temperature shutdown
f) Oil reservoir low level
g) Oil reservoir low low level shutdown
h) Pump A discharge filter high pressure
i) Pump A discharge filter high high pressure
j) Pump B discharge filter high pressure
k) Pump B discharge filter high high pressure
l) Pump return filter high pressure
m) Pump return filter high high pressure.

6.9 Instruments to be supplied by Vendor/Manufacturer, as a minimum

6.9.1 Locally mounted liquid filled pressure gauges at each pump discharge, and before and after oil filters.

6.9.2 Level gauges for the oil reservoir.

6.9.3 Transmitters indicated to alarm in the plant distributed control system DCS

6.9.4 All control valves as required.

6.9.5 Position transducers on each hydraulic cylinder for open and closed valve position indication.

6.9.6 Proximity switches on each locking pin for position indication.

6.9.7 Transmitters for process services in-lieu of direct connected switches.

6.9.8 Devices for indication and operation, such as, pilot lights, pushbuttons, etc.

6.9.9 Vendor/Manufacturer shall provide a P & ID for the hydraulic system, schematic diagrams and/or assembly drawings showing instrument components with a symbol and identification number (Tag No.), so that the component in the system may be easily identified. The Client will furnish tag numbers to the Vendor/Manufacturer by marking up and returning one set of Vendor/Manufacturer's schematic diagrams.

6.9.10 The symbols, letters, and numbers used to identify components shall follow standard "Client's Instrumentation Symbols and Identification". Additional symbols, if used, not covered by the aforementioned standard shall be explained by notes on the diagram.

6.9.11 Hand switches shall be rated at 10 amps for 120 V, 60 Hz. Proximity switches shall be intrinsically safe or hermetically sealed.
6.9.12 All enclosures for the electrical and control system devices, junction boxes, electrical panels and control panels shall be NEMA 4-X stainless steel.
6.9.13 Stainless steel nuts and bolts shall be used for mounting of all control equipment. All electrical and control panels and large junction boxes shall have space heaters with thermostat control set to prevent condensation.
6.9.14 All controls shall be solid state utilizing static switching.
6.9.15 Solid state and static switching systems shall be modularized and designed for easy servicing. Modules shall be designed to resist shock and vibration, and where possible, be interchangeable to reduce stocking of spares.
6.9.16 Short circuit overloads and under voltage protection for each motor shall be provided by the Client. The motor cannot be restarted after loss of power or trip until a manual reset is performed.
6.9.17 All control wiring shall be front connected. Control modules shall be front removable.
6.9.18 Meyers ST type hubs shall be used to connect conduit into electrical boxes and cabinet.
6.9.19 Instruments and other electronic devices installed outside of the control panels shall be designed for satisfactory performance in the field or outdoor locations with no protection from the environment. The Vendor/Manufacturer shall ensure the reliability of electrical components under the following conditions:

- Excessive and normal vibration
- Components over heating
- Corrosion.

6.9.20 Solenoid valves shall be 3-way type with 120VAC coils. The pressure rating of solenoids shall be at least 150% of the system operating pressure. Solenoids shall be designed for no voltage release, that is, when the solenoid is de-energized it moves to the safest position in terms of unheading device operation. This will prevent unheading device operation in the event there is a problem with wiring, power supply etc.
6.9.21 Pressure interlocks for the hydraulic system shall be provided with (3) Honeywell Pressure Transmitters in each interlock service.
6.9.22 Control nameplates, panel device designation nameplates, control panel wireways, and control panel supports shall be attached with stainless steel screws.
6.9.23 Panel wire markers shall be sleeve type. Self-adhesive markers are not acceptable. Purchased equipment shall have manufacturer's standard nameplates. In case of a conflict, this supersedes the attachment electrical specification requirements.
6.9.24 Each control station shall be furnished with a hinged cover that shall be minimum 14-gauge stainless steel. The cover shall be a sealed cover to the control panel so that when closed, the surface containing electrical components is completely covered. Rubber seals shall be fixed to the cover with stainless steel screws or stainless steel rivets. Adhesive applied seals are unacceptable. A mechanical latch shall be provided to secure the cover when in the closed position.
6.9.25 Programming in shall be in ladder logic utilizing Vendor/Manufacturer's standard software development package.
6.9.26 Vendor/Manufacturer shall a competent application engineer to review all installation, follow the commissioning, supervise calibration and initial start-up.

7. Certificates to be provided by Vendor/Manufacturer

According to Brazilian legislation the following INMETRO-Instituto Nacional de Metrologia, Qualidade e Tecnologia certificates shall be presented before the supply:
a- All imported instruments and control and electrical devices shall have the CENELEC certification to be used in refinery explosive atmospheres and have the confirmation of INMETRO - Brazilian institute for certification affairs.
b- The accord of the design issued by an International Certifier to attend the assurance exigencies;
c- All imported materials and goods shall have the INMETRO acceptance certification to be relieved in the customs.

Unheading and Reheading System Operation Sequence

1. Introduction

Based on Client's experience in operating Delayed Coking Units is presented an operational sequence for this type of unit, but the Vendor/Manufacturer is encouraged to propose improvements for operation, reliability and safety.

2. General

Coke Drum top and bottom unheading and reheading operations are executed from their respective control panels located on the cutting and unheading decks respectively, a safe distance from the Coke Drum to be opened.
Coke Drum and hydraulic pump selections are made from the HPU.
Prior to coke cutting, the Coke Drum unheading operation is performed.
Upon selection of the Coke Drum and hydraulic pump, the operator ensures that all permissives are satisfied and control system requirements of the Coke Drum are safe before he initiates the unheading operation.
First, the operator initiates top unheading procedure from a local control panel for the Top Unheading System.
The top unheading valve is first opened.
Once the top unheading valve is completely open and its open position is acknowledged via a proximity switch, the operator then secures the top unheading valve in its open position by a **lockout pin**. DCS then terminates power to close the line block valve.
The operator then initiates bottom unheading procedure from a local control panel for the Bottom Unheading System.
After all permissives are satisfied and control system requirements of the Coke Drum are deemed to be safe, operator then opens the bottom unheading valve.
Once the bottom unheading valve is completely open and its open position is acknowledged via a proximity switch, the operator then secures the bottom unheading valve in its open position by a **lockout pin**. DCS then terminates power to close the line block valve.
Once the top and bottom unheading operation is complete, the operator initiates coke cutting operation.
After all coke in the Coke Drum is cut and discharged, reheading of the top and bottom unheading system is completed in the reverse order.

3. Unheading and reheading operations

Unheading and reheading operations, as currently envisioned, are described in the succeeding paragraphs.
Operations are executed from the top unheading control panel located on the cutting deck and bottom unheading control panel located on the unheading deck, a safe distance from the Coke Drums.
Hydraulic pump selection is accomplished from the hydraulic control panel located on the unheading deck.
Before a Coke Drum is opened, established safety criteria must be satisfied and verified through the Client furnished distributed control system (DCS) and safety instrumented system (SIS). They include, but are not limited to, key lock to energize the system, Coke Drum selection, Coke Drum temperature and pressure, unheading valve selection and position, etc. Only after the safety criteria is met and verified, an operator is allowed to perform the unheading operation.
Once the top and bottom unheading operation is complete, the operator initiates coke cutting operation, by means of high-pressure hydraulic jets the coke is discharged into a concrete pit adjacent to the Coke Drums.
After all coke in the Coke Drum is cut and discharged, reheading of the top and bottom unheading systems shall be completed in the reverse order.
During normal operation, the operator can initiate valve opening and valve closing functions by pressing the appropriate pushbuttons without any further action. However, if any time during the unheading procedure, it becomes necessary to close the unheading valve, the operator is able to do so by pressing and releasing valve close pushbutton.

3.1. Top Unheading Procedure

Operator performs the following procedure for top unheading operation:
a) Unlock key at the DCS to energize the control system.

b) Press “Lamp Test” pushbutton on the hydraulic control panel to ensure that all pilot light indicators are functioning.
c) Verify hydraulic oil level and temperature.
d) Select the pump by pressing “Pump Start” pushbutton. Confirm pump operation via “Pump Running” light on the hydraulic control panel.
e) Select the Coke Drum on the hydraulic control panel. Confirm Coke Drum selection via a pilot light on the hydraulic control panel.
f) Press “Lamp Test” pushbutton on the top unheading control panel to ensure that all pilot light indicators are functioning.
g) Confirm pump operation via “Pump Running” light on the top unheading control panel.
h) Confirm DCS permissive via an indicator light on the top unheading control panel.
i) Select the Coke Drum on the top unheading control panel. Confirm Coke Drum selection via a pilot light on the top unheading control panel.
j) When all permissives are met and confirmed, DCS initiates a signal to open the correct solenoid valve at the hydraulic control unit discharge branch manifold. This allows the pump to pressurize the hydraulic control manifold. The hydraulic oil is deadheaded against the pressure line block valve.
k) Confirm the “Valve Closed” and Coke Drum “Locked Closed” indicating lights are illuminated on the top unheading control panel.
l) Pull out the lockout pin out of a “Locked Closed” receptacle at the unheading valve. Confirm broken contact via a proximity switch signal illuminating an indicating light on the top unheading control panel. This will allow the DCS to open the pressure line control valve, permitting hydraulic oil to deadhead against the directional control valve. The line pressure is recorded in the control system.
m) Confirm line pressure via a pressure gauge at the hydraulic manifold enclosure.
n) Confirm “Locked Closed” indicator light on the top unheading control panel is not illuminated.
o) Press and release the “Valve Open” pushbutton. “Valve Open” indicator light will illuminate solid when the valve is fully open.
p) Insert the lockout pin into the “Locked Open” receptacle at the unheading valve. Confirm made contact via a proximity switch signal illuminating an indicating light on the top unheading control panel. This will allow the DCS to terminate power to close the pressure line block valve.
q) Confirm the “Locked Open” indicator light is illuminated on the top unheading control panel.
r) Initiate coke cutting drill assembly operation.

3.2. Bottom Unheading Procedure

Operator performs the following procedure for bottom unheading operation:
a) Unlock key at the DCS to energize the control system.
b) Confirm “Pump Running” indicator light is illuminated on the bottom unheading control panel.
c) Confirm “DCS Permissive” indicator light is illuminated on the bottom unheading control panel. This indicates that all permissives for the selected Coke Drum are met.
d) Confirm “Top Unhead Open” indicator light is illuminated on the bottom unheading control panel.
e) Confirm Coke Drum selection indicator light is illuminated on the bottom unheading control panel.
f) Confirm “Valve Closed” indicator light is illuminated on the bottom unheading control panel.
g) Confirm “Locked Closed” indicator light is illuminated on the bottom unheading control panel.
h) Pull out the lockout pin out of a “Locked Closed” receptacle at the unheading valve. Confirm broken contact via a proximity switch signal illuminating an indicating light on the top unheading control panel. This will allow the DCS to open the pressure line control valve, permitting hydraulic oil to deadhead against the directional control valve. The line pressure is recorded in the control system.
i) Confirm “Locked Closed” indicator light is illuminated.
j) Press and release the “Valve Open” pushbutton. “Valve Open” indicator light will illuminate solid when the valve is fully open. A mechanical indicator will indicate locally the valve open position. Pressure will drop at the “Valve Open” pressure gauge on the hydraulic manifold enclosure.
k) Insert the lockout pin into the “Locked Open” receptacle at the unheading valve. Confirm made contact via a proximity switch signal illuminating an indicating light on the bottom unheading control panel. This will allow the DCS to terminate power to close the pressure line block valve. Pressure will drop at the “Manifold” pressure gauge on the hydraulic manifold enclosure.
l) Confirm the “Locked Open” indicator light is illuminated on the bottom unheading control panel.
m) Initiate coke cutting.

3.3. Top Reheading Procedure

Operator performs the following procedure for top reheading operation:

a) Confirm drum selection, DCS Permissive, pump running, valve open, and valve locked open indication on the top unheading control panel.
b) Pull out the lockout pin out of a “Locked Open” receptacle at the unheading valve. Confirm broken contact via a proximity switch signal illuminating an indicating light on the top unheading control panel. “Manifold” pressure gauge at the hydraulic manifold enclosure will show pressure rise.
c) Confirm “Valve Locked” indicator light on the top unheading control panel is not illuminated.
d) Press and release the “Valve Close” pushbutton. “Valve Close” indicator light will illuminate solid when the valve is fully closed. A mechanical indicator will indicate locally the valve closed position. Pressure will rise at the “Manifold” pressure gauge on the hydraulic manifold enclosure.
e) Insert the lockout pin into the “Locked Closed” receptacle at the unheading valve. Confirm made contact via a proximity switch signal illuminating an indicating light on the top unheading control panel.
f) Confirm drop in pressure at the “Manifold” pressure gauge on the hydraulic manifold enclosure.
g) Confirm “Locked Closed” indicator light is illuminated.

3.4. Bottom Reheading Procedure

Operator performs the following procedure for bottom reheading operation:
a) Confirm drum selection, DCS Permissive, pump running, valve open, and valve locked open indication on the bottom unheading control panel.
b) Pull out the lockout pin out of a “Locked Open” receptacle at the unheading valve. Confirm broken contact via a proximity switch signal illuminating an indicating light on the bottom unheading control panel. “Manifold” pressure gauge at the hydraulic manifold enclosure will show pressure rise.
c) Confirm “Valve Locked” indicator light on the bottom unheading control panel is not illuminated.
d) Press and release the “Valve Close” pushbutton. “Valve Close” indicator light will illuminate solid when the valve is fully closed. A mechanical indicator will indicate locally the valve closed position. Pressure will rise at the “Manifold” pressure gauge on the hydraulic manifold enclosure.
e) Insert the lockout pin into the “Locked Closed” receptacle at the unheading valve. Confirm made contact via a proximity switch signal illuminating an indicating light on the bottom unheading control panel.
f) Confirm drop in pressure at the “Manifold” pressure gauge on the hydraulic manifold enclosure.
g) Confirm “Locked Closed” indicator light is illuminated.
h) Stop the pump at the hydraulic control panel or DCS.
i) Confirm “Pump Running” indicator light is not illuminated.