PETROBRAS

N-2451	REV. D	ENGLISH	04 / 2016

Vessels in Terminals - Marine Loading Arm

Specification

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

CONTEC
Comissão de Normalização Técnica

SC - 40
Maritime Transportation
Petroleum and Derivatives
Bio-Fuels

Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard N-1. For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

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Foreword

This Standard is the English version (issued in 05/2016) of PETROBRAS N-2451 REV. D 04/2016. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard establishes requirements for the provision of loading arms and their auxiliary systems for loading and offloading operations on ships and vessels, complementing the “Design and Construction Specification for Marine Loading Arms” (OCIMF).

1.2 This Standard applies to specifications established as of its date of issuance.

1.3 This Standard contains Technical Requirements and Recommended Practices.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

INMETRO Portaria nº 179/2010 - Requisitos de Avaliação da Conformidade para Equipamentos Elétricos e Eletrônicos para Atmosferas Explosivas;

PETROBRAS N-2 - Pintura de Equipamento Industrial;

PETROBRAS N-133 - Soldagem;

PETROBRAS N-2167 - Classification Of Areas For Electrical Installations At Petroleum, Gas And Derivate Transportation Facilities;

OCIMF 3rd Edition 1999 - Design and Construction Specification for Marine Loading Arms;

OCIMF 4th Edition 1991 - Recommendations for Oil Tanker Manifolds and Associated Equipment;

OCIMF/ISGOTT - International Safety Guide for Oil Tankers and Terminals.

NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1
rated diameter
loading arm flange diameter which is connected to the ship’s load intake flange

3.2
operational envelope
area required for a loading arm operation which comprises all possible locations of the ship's manifold on the docking board, depending on the current, tide variation, freeboard and vessel heave during operations

3.3
oleo dynamic central
set of equipment including pumps, a reservoir, hydraulic oil, lines and valves, which purpose is to provide movement to the loading arms

3.4
console
equipment which combines the loading arm drive devices commands

3.5
twin arm
loading arm in which the branches of the vapor and liquid phases are united with each other, so that the movement takes place as if it were a single arm, being used for handling products with high vapor pressure (GLP)

4 General Conditions

4.1 All exceptions to the specifications contained in this Standard and in the OCIMF shall be previously identified as of the supplier's proposal.

4.2 Agreement from the supplier with this Standard's requirements does not exempt him from the responsibility of providing equipment and accessories which are appropriate and certificated as to the specified service conditions.

4.3 The loading arm shall be provided in accordance with the requirements contained in the Data Sheet of Annex A, which shall be completed by the manufacturer as of the submission of the supplier's proposal.

5 Design

5.1 The loading arm shall be calculated when it is completely full and completely empty, in addition to considering the most critical conditions of the following factors: weight of the fluid, accidental loads, thermal requirements, fluid pressure and wind pressure.

NOTE In order to determine the design pressure, the hydraulic transients shall be taken into account.

5.2 All arms shall have:

a) a rested locking system;
b) drainage nozzles and their respective valves;
c) ladder with a fall arrestor and intermediate platforms for maintenance up to the top of the column.

5.3 For the arms of clear (except for GLP) and dark products, a vacuum breaker valve (vent) shall be added and opened for when draining provided there is not a nitrogen injection system. Its start shall be enabled from a location near the sip's coupling flange.

5.4 The loading arms shall contain supports for minimizing the efforts in their connection to the ship load intake. These supports shall stand either on the tray grid of the ship load intake (manifolds) or on the ship deck.

NOTE The publication "OCIMF-Recommendations for Oil Tanker Manifolds and Associated Equipment" further details the positioning and sizing of the load tray as functions of the ship size, and it shall be consulted in the design and technical specification of the loading arm.

6 Drive System

6.1 Manual Drive

Loading arms with a rated diameter of up to 6" may use manual drive with up to 2 operators and a total load of 60 kgf (588 N). **[Recommended Practice]**

6.2 Hydraulic Drive

6.2.1 Loading arms with a rated diameter equal to or higher than 8" shall use hydraulic drive.

NOTE For a bed which contains only one arm, manual drive may be used up to a rated diameter of 8". **[Recommended Practice]**

6.2.2 The following items shall be provided:

a) hydraulic pressurization unit with electric drive and 2 pumps, one of normal operation and the back-up, selectable;
b) manual pump for operations in case of system failure;
c) hydraulic control panel for maneuvering arms and supervision of the systems, enabling regulation of the arms speed;
d) two speeds system: approach and coupling;
e) hydraulic accumulator which enables the quick disengagement of the loading arms in an emergency;
f) hydraulic blocking and a mechanical (manual) latch in order to ensure lack of motility of the arm in the rested position;
g) compact assembly hydraulic central in a proper booth, enabling easy access to its components and a good operation visibility;
h) information on PETROBRAS lubricants (oils and greases) provided for the system.

7 Emergency Disengagement and Coupling Systems

7.1 A hydraulic or manual drive quick coupling system (connection and disconnection) shall be provided for the normal operations.

7.2 Emergency disengagement with hydraulic drive shall be provided for an arm of over 6".

8 Control and Command Systems

The control and command systems described in this Section apply only to hydraulic-driven loading arms.

8.1 The loading arms shall have a double command system which enables the driving of each arm from the main command or via a portable command.

8.2 The main command shall have, at any time, predominance over the portable command, and shall be in charge of the main movements of the arm to its position along the ship-coupling flange. Via a selector switch, the main command shall issue or not, with an appropriate signaling, a permit for the operator to command the arm actions with the portable command.

8.3 The main command shall be on a proper console, mounted to a cabinet built with an appropriate enclosure and include all actuators, valves, signals, hydraulic central's pump commands, automatic testing and alarm of the 4 arm movements. This console, when installed outdoors, shall be fitted with a cap with a visor for protection of valves and other signaling and driving devices.

NOTE The use of ram-type valves is prohibited on the hydraulic circuit.

8.4 Each loading arm shall have a set of wires and devices for connection with the portable command, next to arm end. When specified, the remote command may be done without connecting wires to the control system, and may be controlled by light or by an electronic frequency, provided reliability on maneuvers is ensured.

NOTE The frequencies in use for the remote control system shall be proper so as not to interfere in the already existing systems.

8.5 The portable command shall consist of a device which enables the exclusive command of any of the loading arms, thus enabling all resources in order to perform all movements of the arm to which it is connected, allowing a fine adjustment of the coupling operation (connection and disconnection).

8.6 The portable command shall have dimensions and the weight to enable easy handling, transportation and operation as well as a handle-type support with means which also enable the handling of connecting wires, and the whole set shall be compatible for use by only one individual.

8.7 The portable command shall have a lighting signaling device which indicates when the console's main command allows local operation, transferring command.

8.8 As for a portable command with wires, they shall be suitable for the operating conditions, capable of withstanding local bad weather and shall have an appropriate length. It shall be connected to the arm wires by a junction box suitable for a classified area.

8.9 The console shall also have an alarm panel which gives audible and visual indications of operations and/or situations deemed critical, such as limitation of arm movements during an operation with at least three alarm levels: pre-alarm, 1st stage and 2nd stage.

8.10 In addition to the internal alarms, the installation of an audible alarm must be provided for indication of abnormal situations, off the console.

8.11 All actuators shall sport identification of their functions in the following languages: Portuguese (Brazil) and English.

8.12 The command system shall provide communication with the supervisory system of the terminal's operational area through a communication protocol specified in the Data Sheet.

9 Electric Installations

9.1 All instruments, equipment and electrical/electronic installations shall be appropriate to the electrical classification of the area to which they belong, in accordance with PETROBRAS N-2167 and specific area classification drawings of the installation location. Also, the supplier shall submit a Certificate of Compliance for installation in classified areas (explosive atmosphere), issued by an organization accredited by the INMETRO Ordinance nr. 179/2010.

9.2 Where there are safety devices and components which require direct reset or maintenance access, the installation of these devices outside the classified area shall be provided.

9.3 All electrical installations of the loading arm shall be powered from a proper panel, preferably located next to the command console.

9.4 The command, signaling and alarms system shall be fitted with a no break in case of a power outage.

9.5 The loading arms shall be electrically insulated from the ship via an insulator flange, according to OCIMF/ISGOTT.

9.6 All components and accessories of the loading arm upstream of the insulating flange mentioned in 9.5, shall have their electrical continuity ensured with the pier's grounding system.

9.7 The auxiliary transformer shall be of the dry type, encapsulated with epoxy.

9.8 The micro-switches and/or the loading arm sensors shall be of the static-type, encapsulated with epoxy.

9.9 Due to the conditions of the marine environment, all electrical equipment of the panels, instruments and components of the hydraulic system shall be resistant to bad weather.

9.10 All equipment and accessories used in electrical installations such as: engines, panels, boxes and cabinets, these shall have connectors for 25 mm^2 grounding wires.

10 Materials

10.1 Materials shall be in accordance with the OCIMF recommendations, shall have a certificate of compliance with the standards accepted by PETROBRAS, and:

a) the hydraulic cylinders' rods shall be coated with hard chromium;
b) pipelines and accessories of the hydraulic circuits and of the lubrication line shall be made of stainless steel;

c) the weave of flexible hydraulic hoses shall be made of stainless steel. Where applicable, hoses shall be non-conductive.

NOTE It is prohibited to use aluminum as much for structural purposes as it is for materials such as pipes, swivel joints, connections and others.

10.2 Anchor bolts shall be sized for the design condition of the arms and provided by the supplier, and shall be finished with zinc-nickel.

NOTE As for the already existing installations, the supplier shall design and supply devices which adapt the new arms to the already existing anchor bolts (base plate), in structural steel.

10.3 PETROBRAS shall supply a vendor list for the main components of the system.

11 Welding

11.1 The welding process shall be performed in accordance with PETROBRAS N-133.

11.2 On the welding processes, these shall be ensured and proven:

a) the qualified welding procedures;
b) qualification of welders and welding operators;
c) inspection of welds.

12 Painting

12.1 The loading arms shall be painted in accordance with PETROBRAS N-2.

12.2 The color of the finishing coat on the arms shall be security-yellow, Munsel rating 5Y 8/12. On the outboard arm, 140mm-wide and 140mm-spaced black horizontal strips shall be applied, Munsel rating N-1.

13 Inspections and Tests

13.1 The loading arm shall undergo a release for service inspection, according to the recommendations of the manufacturer's literature, including checking the operation of the handling mechanisms, safety devices and watertightness test.

13.2 On the inspection reports for operational release, all items inspected and performed working checks shall be informed.

14 Documents

Along with the loading arm, a data book shall be delivered, containing all the drawings, certificates, records, calculation memories and results of inspections and tests relating to the documents listed in the Data Sheet of Annex A and the OCIMF recommendation (the contract documents).

At the time of purchase of the loading arm, the manufacturer shall adhere to the vendor-list of components presented by PETROBRAS.

15 Supervision of Assembly, Commissioning and Training

Suppliers of the loading arm system shall provide the O&M crew with on-site supervision of assembly, commissioning, and training.

PETROBRAS	**DATA SHEET**	**Nº**
	CLIENTE:	**FOLHA** **de**
	PROGRAMA:	
	ÁREA:	
	TÍTULO: **MARINE LOADING ARM**	

ÍNDICE DE REVISÕES

REV.	DESCRIÇÃO E/OU FOLHAS ATINGIDAS

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATA									
PROJETO									
EXECUÇÃO									
VERIFICAÇÃO									
APROVAÇÃO									

PETROBRAS	DATA SHEET	Nº	REV.
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GENERAL DATA

APPLICABLE TO:	☐ PROPOSAL	☐ PURCHASE	☐ AS
TAG No.			
NOMINAL DIAMETER (in)			
PREDOMINANT FLUID			
MANUFACTURER			
MODEL / SÉRIES			

OPERATING DATA

ITEMS	VESSEL LOAD		VESSEL UNLOAD	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
NOMINAL FLOWRATE (m^3/h)				
OPERATING PRESSURE (kgf/cm^2 abs.)				
OPERATING TEMPERATURE (°C)				
SPECIFIC MASS (kg/m^3)				
STEAM PRESSURE (kgf/cm^2 abs.)				
VISCOSITY @ OPERATING TEMPERATURE (cSt)				
ΔP MAXIMUM ALLOWABLE (kgf/cm^2)				
DESIGN PRESSURE (kgf/cm^2 abs.)				
DESIGN TEMPERATURE (°C)				

PROJECT DATA

☐ WHARF ☐ PIER ☐ FLOATING

DISTANCE BETWEEN ℄ OF ARMS AND THE EDGE OF THE WHARF		A=	m
DISTANCE BETWEEN THE EDGE OF THE WHARF AND FACE OF FENDER	MINIMUM (COMPRESSED FENDER)	B=	m
	MAXIMUM (FENDER WITHOUT LOAD)	B=	m
WHARF LEVEL	RELATING TO MINIMUM TIDE	C=	m
	RELATING TO MAXIMUM TIDE	C=	m
MAXIMUM VARIATION OF WATER LEVEL		D=	m
DISTANCE BETWEEN ℄ OF THE ARM INTAKE FLANGE AND THE WHARF FLOOR		E=	m
SAME AS ABOVE, BY THE BOTTOM OF COLUMN (OPTIONAL)		F=	m
ANY OTHER RESTRICTIONS OR OBSTACLES, SUCH AS PIPES, VALVES AND MANIFOLDS THAT MAY AFFECT THE ARM DESIGN (PROVIDE A SKETCH)		G=	m
		H=	m
		I=	m
DISTANCE BETWEEN ADJACENT ARMS (it may vary depending on the size of the arm)		J=	m

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VESSEL DATA

CATEGORY	SIZE (dead-weight)	VOLUME (m³)	LOA (m)
THE SMALLEST			
THE LARGEST			
MEDIUM			

DISTANCE BETWEEN THE FLANGE FACE AND THE SIDE	MINIMUM	K =	m
	MAXIMUM	L =	m
DISTANCE BETWEEN ℄ OF FLANGE OF SMALLEST LOADED VESSEL RELATING TO MINIMUM TIDE (LLW)		M =	m
DISTANCE BETWEEN ℄ OF FLANGE OF THE LARGEST EMPTY VESSEL RELATING TO MAXIMUM TIDE (HHW)		N =	m
CROSS MOVEMENT OF VESSEL (PERPENDICULAR TO WHARF)		O =	m
LONGITUDINAL MOVEMENT OF VESSEL (PARALLEL TO WHARF)		P =	m
SPACING BETWEEN CONSECUTIVE FLANGES IN THE MANIFOLD OF THE VESSEL	MINIMUM	Q =	m
	MAXIMUM	Q =	m
VESSEL OPEN RAIL HEIGHT ○ YES ○ NO		S =	m
DISTANCE BETWEEN ℄ OF VESSEL FLANGE AND THE DECK	MINIMUM	T =	m
	MAXIMUM	U=	m

ARM FLANGES DATA

TAG No.		
BASE OR "RISER"	NOMINAL DIAMETER (in)	
	CLASS (psi)	
	MATERIAL	
	GASKET	
TRIPLE OR 80-STYLE	NOMINAL DIAMETER (in)	
	CLASS (psi)	
	MATERIAL	
	GASKET	

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ADDITIONAL DATA

OPERATING MODE	WIND SPEED FOR DESIGN (m/s)		OPERATING TIME (s)	
☐ MANUAL	IN OPERATION		RELEASE VALVE BLANKING	
	PARKED		OPENING OF THE RELEASE (ERS)	
☐ OLEODYNAMIC	PREVAILING DIRECTION		COLUMN DRAINAGE	

COMMUNICATION PROTOCOL	

LOCAL POWER SUPPLY VOLT 60 Hz 3F

PRODUCTS	LOAD	UNLOAD	BERTH No.						VISCO. cSt	MASS. kg/m^3 @ OP. T.	PRESSURE kgf/cm²		TEMPERATURE °C		FLOWRATE
											MAXIMUM OPER.	DESIGN	OPER.	DESIGN	m^3/h

NOTES

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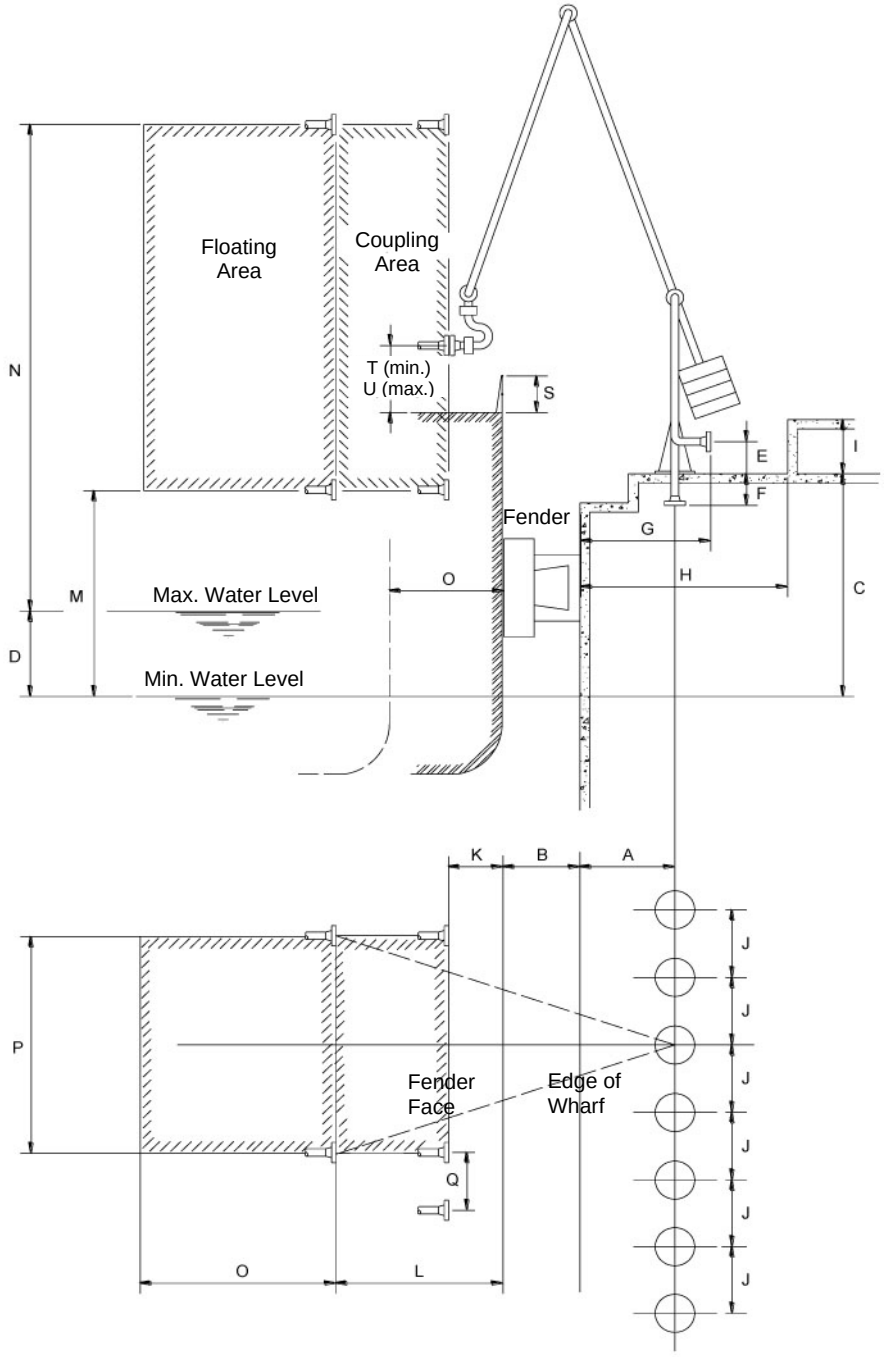

EXISTING ARMS	Ø	SIMULTANEOUS ARMS				

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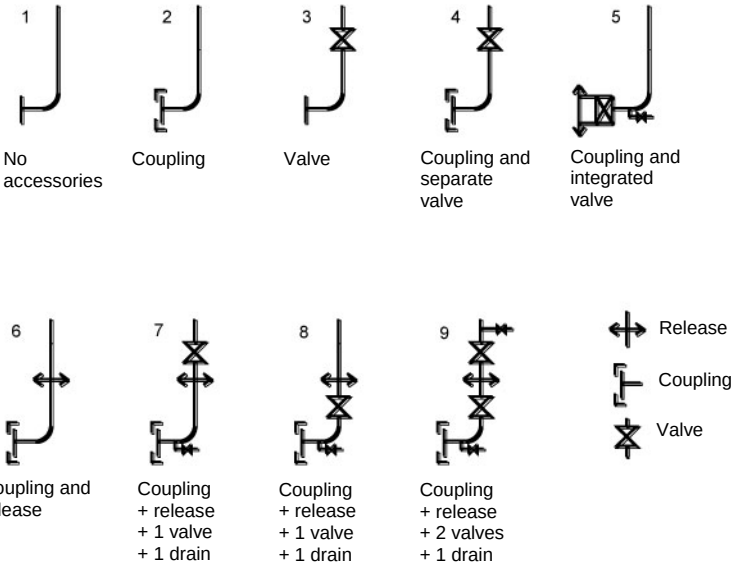
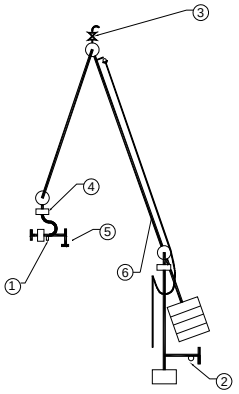
Typical Settings





RELEASE	☐ MANUAL	☐ HYDRAULIC		
COUPLING	☐ MANUAL	☐ HYDRAULIC	☐ SIGNAL	
VALVE	☐ MANUAL	☐ HYDRAULIC	☐ PNEUMATIC	☐ ELECTRIC

DESCRIPTION				TYPE
SETTING SELECTED FOR THE TRIPLE JOINT OR 80-STYLE (SEE FIGURE A.1)				
MANUAL				
HYDRAULIC				
TRIPLE JOINT OR 80-STYLE NIPPLE [1]				
RISER OR COLUMN NIPPLE [2]				
NON-RETURN VACUUM – BREAKING VALVE				☐ MAN ☐ HYDR. ☐ PNEU.
ELECTRICAL GASKET [4]				
JACKET [5]				
DRAIN LINE	☐ WITH PUMP	☐ VALVE	☐WITHOUT PUM	
STEAM HEATING	☐ BY	☐ BY PURCHASER		
ELECTRICAL HEATING	☐ BY	☐ BY PURCHASER		
THERMAL INSALATION	☐ BY	☐ BY PURCHASER		MATERIAL
				WEIGHT
DRAIN LINE AND PURGE WITH NITROGEN				
LUBRICATION SYSTEM	☐ MANUAL	☐ CENTRALIZED	☐ AUTOMATIC	

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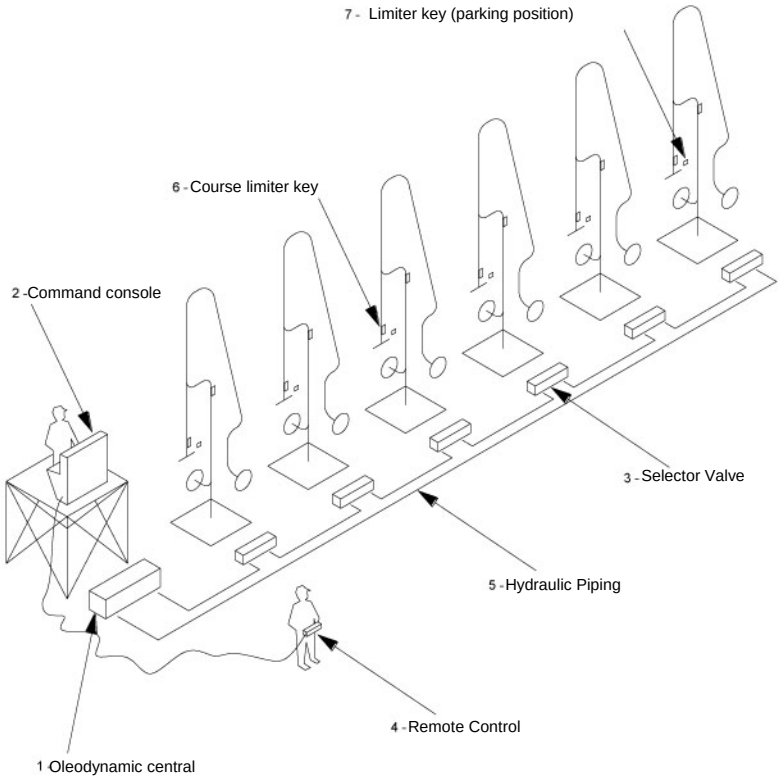

ITEMS	DESCRIPTION				YES	NO
1	OLEODYNAMIC CENTRAL					
2	COMMAND CONSOLE	☐ SEPARATED	☐ HYDRAULIC			
		☐ COMBINED	☐ WITH 2 PUMPS			
3	SELECTOR VALVE					
4	PORTABLE REMOTE CONTROL	☐ STANDARIZED	☐ WIRELESS			
5	REMOVAL LIMIT	☐ PRE-ALARM	☐ 1ST STAGE	☐ 2ND STAGE		
6	VERTICAL LIMIT	☐ PRE-ALARM	☐ 1ST STAGE	☐ 2ND STAGE		
7	TURNING LIMIT	☐ PRE-ALARM	☐ 1ST STAGE	☐ 2ND STAGE		
	HYDRAULIC ACCUMULATOR FOR RETRACTION		☐ 1ST STAGE	☐ 2ND STAGE		
8	PARKING INDICATOR					
9	CONTINUOUS POSITION MONITORING SYSTEM					
10	FLANGED SWIVEL JOINTS					
11	GROUNDING WITH THE WHARF					
12	LOCKING SYSTEM IN IDLE POSITION				X	
13	DRAINAGE AND RESPECTIVE DRAIN VALVE				X	
14	LADDER WITH GUARDRAIL AND INTERMEDIATE PLATFORMS TO THE TOP OF COLUMN				X	
15	OUTLET TO PRESSURE GAUGE ON THE TOP OF COLUMN					
16	ARM SPEED ADJUSTMENT					
17	JOINT LUBRICATION SYSTEM CENTRALIZED IN COLUMN BASE					
18	PIGGABLE ARM					

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INSPECTIONS AND TRIALS		
	OPENING AND CLOSING VALVES	
	MANUAL AND EMERGENCY RELEASE	
	ALARMS AND INTERLOCKS	
	LOCK AGAINST ACCIDENTAL OPENING BY HYDRAULIC FAILURE	
	RELEASE WHEN SUBJECT TO FORCES AND MOMENTUM	
	OCIMF REQUIREMENTS ("LOADING ARMS SAFETY PROVISIONS")	
	ELECTRICAL RATING PETROBRAS N-2167	
	WELDING INSPECTION 9.2 OF PETROBRAS N-133	
	MECHANISM FOR LOWERING AND LIFTING THE ARM	
	MECHANISM FOR LATERAL DISPLACEMENT	
	SAFETY DEVICES	

DOCUMENTS TO BE PROVIDED WITH THE ARM			
	DOCUMENT LIST		CATALOGUE OF MAIN COMPONENTS
	DATA SHEET COMPLETED		INSTALLATION AND MAINTENANCE MANUAL
	CURVES FOR LOAD LOSS		OPERATION MANUAL
	CERTIFIED AND APPROVED DRAWINGS		ELECTRICAL-HYDRAULIC CIRCUITS MANUAL
	MECHANICAL AND HYDROSTATIC TESTING REPORT		HYDRAULIC DRAWINGS
	LIST OF SPARE PARTS FOR 2 YEARS OF OPERATION		ELECTRICAL DRAWINGS
	CERTIFICATE OF MATERIALS		PNEUMATIC CIRCUIT DRAWINGS
	WARRANTY CERTIFICATE		ADDITIONAL DOCUMENTATION AS PROVIDED IN OCIMF AND TECHNICAL SPECIFICATION (ET)

DOCUMENTS PROVIDED BY PETROBRAS (ATTACHED)			
	TECHNICAL SPECIFICATION (ET)		

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Não existe índice de revisões.	
REV. B	
Partes Atingidas	**Descrição da Alteração**
	Revalidação
REV. C	
Partes Atingidas	**Descrição da Alteração**
Todas	Revisadas
REV. D	
Partes Atingidas	**Descrição da Alteração**
5.4	Adicionado