PETROBRAS | N-1586 | REV. C | ENGLISH | 12 / 2010

Air Cooler - Data Sheet

Standardization

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 - 02
Tank and Vessels

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.

.

Foreword

This Standard is the English version (issued in 12/2012) of PETROBRAS N-1586 REV. X 12/2010, including its Erratum - 12/2012). 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 document standardizes Data Sheets of the A and B Appendices for air cooler, which will be used in designs for PETROBRAS.

1.2 This Standard applies for designs beginning as of its date of issuance.

1.3 This Standard contains only Technical Requirements.

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.

Norma Regulamentadora nº 13 (NR-13) - Caldeiras e Vasos de Pressão;

PETROBRAS N-381 - Execução de Desenho e Outros Documentos Técnicos em Geral;

PETROBRAS N-1521 - Identificação de Equipamentos Industriais;

PETROBRAS N-1858 - Projeto e Fabricação de Resfriador a Ar.

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 General Conditions

3.1 The Data Sheets in the A and B Appendices are used to record the buyer's requirements and the supplier's design details and, after they are completed, they must be a permanent document of the equipment.

3.2 The Data Sheet form is standardized in A4 size as:

a) Appendix A - form with units of the Engineering system;
b) Appendix B - form with units of the International Units (SI) system.

3.3 For completing the headings and footnotes of the Data Sheets on A and B Appendices, the requirements of the standard PETROBRAS N-381 shall be met

3.4 If continuation of the Data Sheet is necessary, use the applicable models of PETROBRAS N-381. The applicable models of PETROBRAS N-381 shall also be used for notes, complementary details, as well as to post the nozzle orientation drawing.

3.5 Identification of the air cooler shall be executed in compliance with PETROBRAS N-1521 and recorded in the heading for equipment name (air cooler), on the right.

3.6 PETROBRAS N-1858 shall be met for completion of the Data Sheet in the A and B Appendices.

3.7 When completing the Data Sheets of the A and B Appendices, the following requirements shall be adhered to:

a) complete only the applicable fields, eliminating the fields which are non applicable to the specific design with a horizontal mark;
b) on blank lines, add eventual complementary data of that specific design.

3.7 The A and B Appendices to this Standard are made of 2 forms mentioned in 3.2. Reproducible originals of both forms may be provided by CONTEC. The forms are available in item “Formulários Editáveis” at the following URL: http://nortec.engenharia.petrobras.com.br/formzip/N-1541B.ZIP

PETROBRAS	DATA SHEET	Nr.	
	CLIENT:		SHEET of
	PROGRAM:		
	AREA:		
	TITLE: Air Cooler		

REVIEW INDEX

REV.	DESCRIPTION AND/OR PAGES CONCERNED

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE									
DESIGN									
EXECUTION									
CHECK									
APPROVAL									

PETROBRAS

DATA SHEET

Nr. | REV.

SHEET of

TITLE:

Air Cooler

1- GENERAL DATA

SERVICE:			
THE FOLLOWING ITEMS ARE PLACED IN THE SAME UNIT:			
GENERAL DIMENSIONS:	DRAUGHT: ☐ INDUCED ☐ FORCED		Nr. BAYS:
AREA/ITEM - FINNED TUBE: m^2	BARE TUBE:		m^2
HEAT EXCHANGED: kcal/h	LMTD (CORRECTED):		
TRANSFER RATE - FINNED TUBE	BARE TUBE-SERVICE:	CLEAN:	$kcall/h.m^2.ºC$
AVAILABLE AREA: m^2	WEIGHT OF THE BUNDLE: kgf		

2 - OPERATION

TUBE SIDE

FLUID:				DENSITY - LIQUID:		
TOTAL FLOW RATE: kg/h				FREEZE POINT:		ºC
	INLET		OUTLET	BUBBLE POINT: ºC	POUR POINT:	ºC
TEMPERATURE ºC				THERM. CONDUT. (V) (L):	kcal/kg.ºC@	ºC
LIQUID kg/h				LATENT HEAT:		kcal/kg
VAPOR kg/h	PM			THERM. CONDUT. (V) (L):	kcal/m.ºC@	ºC
NON-CONDENSABLE kg/h	PM			OPERATION PRESSURE - INLET:		kgf/cm^2
STEAM kg/h				ALLOWABLE PRESSURE DROP:		kgf/cm^2
WATER kg/h				CALCULATED PRESSURE DROP:		kgf/cm^2
VISCOSITY (V)(L) cP				INT. FOULING COEFF.:		$m^2.C.h/kcal$

AIR SIDE

AIR FLOW RATE/ITEM:	NORMAL m^3/h	ALTITUDE:	m
AIR FLOW RATE/FAN:	m^3/h	INLET TEMPERATURE:	ºC
STATIC PRESSURE:	mm H_2O	OUTLET TEMPERATURE:	ºC
FACE VELOCITY:	m/s	MIN. AMBIENT TEMP.:	ºC

3 - CONSTRUCTION

DESIGN PRESSURE: kgf/cm^2	TEST PRESSURE: kgf/cm^2	DESIGN TEMP.: ºC

TUBE BUNDLE		HEADER		TUBES	
DIMENSIONS: m	Nr. ROWS:	TYPE:		MATERIAL:	
Nr./BAYS:		MATERIAL:		OUT. DIAM.:	THICK.: mm
ARRANGEMENT:		Nr. PASSES:	INCL.:	Nr. TUBES/BUNDLE:	LENGTH: m
BUNDLES: ☐ PARAL. ☐ SERIES		PLUGS-TYPE:	MAT.:	PITCH: mm	JOIN. TUBE/TUBESHEET:
BAYS: ☐ PARAL. ☐ SERIES		GASKET MAT.:		**FINS**	
BUNDLE FRAME MAT.:		CORROSION ALLOWANCE: mm		TYPE:	
MISCELLANEOUS		INLET NOZZLE DIAM.:		MATERIAL:	
FRAME MAT.:	LADDER:	OUTLET NOZZLE DIAM.:		EXTERNAL DIAM.: mm	
PLENUM CH. MAT.:	PLAT.:	PRESSURE RATING:		THICKNESS: mm	
VIBRATION SWITCH:		NOZZLES GASKET:		Nr./INCH:	

4 - MECHANICAL EQUIPMENT

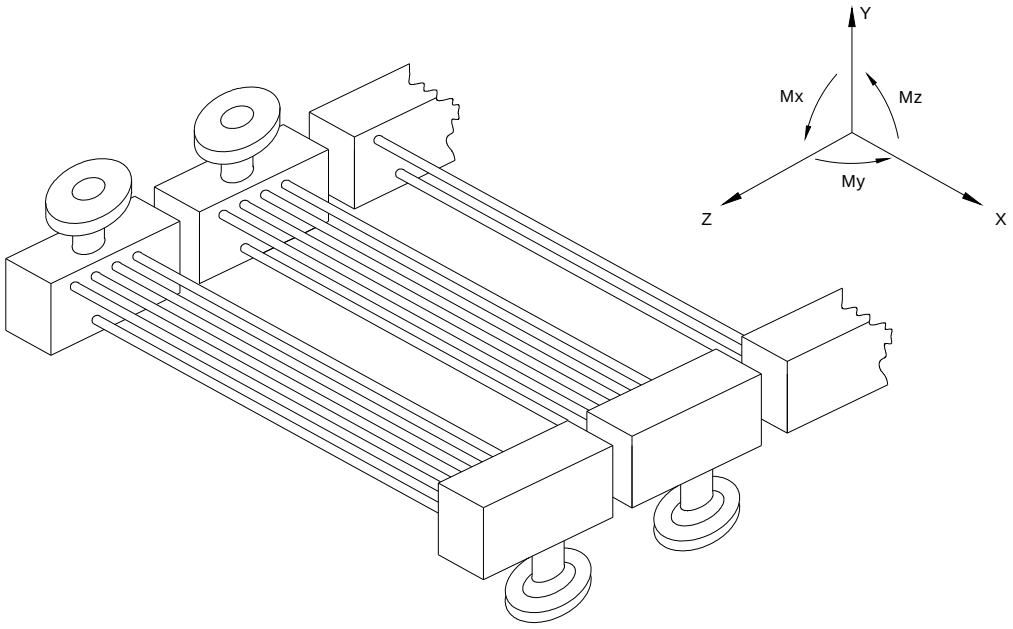
FAN		DRIVER		SPEED REDUCER
MANUF.:	MODEL:	TYPE:	STANDARD:	TYPE:
Nr./BAYS:	kW/FAN:	Nr./BAYS:	hp/DRIVER:	Nr./BAYS:
DIAMETER: m	rpm:	rpm:		MODEL:
Nr. BLADES:	PITCH: ☑ MAN. ☐ AUTOM.	ENCLOSURE TYPE:		SERVICE CLASS AGMA (kW):
BLADES MAT.:	ANG.:	VOLT/PHASE/CYCLES: V / / Hz		REDUCTION RATIO:
HUB MAT.:	NOISE L.: dB(A)	MANUFACTURER:		MANUFACTURER:

COUPLING	TYPE:	MODEL:	MATERIAL:	MANUFACTURER:

CONTROL	☐ MANUAL ☑ AUTOMATIC	☐ LOUVER OPEN. CONTROL	☑ FAN BLADE PITCH	☐ FAN. SPEED. VAR.
	ACTION ON AIR FAILURE	FAN PITCH: MIN./MAX.	LOUVER: OPEN/CLOSED	FAN SPEED

NOTES:

PETROBRAS	DATA SHEET	Nr.	REV.
			SHEET of
	TITLE: Air Cooler		



ALLOWABLE LOADS

DIRECTION	COOLER FRAME	NOZZLES	
		INLET	OUTLET
Fx (kgf)			
Fy (kgf)			
Fz (kgf)			
Mx (kgf)			
My (kgf.m)			
Mz (kgf.m)			

	ITEM		
1	EXTREMITIES WHERE THE TUBE BUNDLES ARE FIXED TO PREVENT MOVEMENT IN DIRECTION X		☐ INLET ☐ OUTLET
2	TUBE BUNDLES WITH FREEDOM TO MOVE IN DIRECTION Z MOVEMENT ALLOWED FOR EXTERNAL BUNDLES IN DIRECTION Z		☐ YES ☐ NO
3	MODIFICATIONS TO ALLOW GREATER MOVEMENTS IN DIRECTION Z ALLOWED MOVEMENTS		mm
4	FRICTION COEFFICIENT OF SLIDING PIECES		mm
5	WEIGHT OF EACH TUBE BUNDLE	EMPTY	kgf
		WATER-FILLED	kgf

PETROBRAS	DATA SHEET	Nr.	
	CLIENT:		SHEET of
	PROGRAM:		
	AREA:		
	TITLE: Air Cooler		

REVIEW INDEX

REV.	DESCRIPTION AND/OR PAGES CONCERNED

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE									
DESIGN									
EXECUTION									
CHECK									
APPROVAL									

PETROBRAS

DATA SHEET

Nr. | REV.

SHEET of

TITLE:

Air Cooler

1- GENERAL DATA

SERVICE:

THE FOLLOWING ITEMS ARE PLACED IN THE SAME UNIT:

GENERAL DIMENSIONS: | DRAUGHT: ☐ INDUCED ☐ FORCED | Nr. BAYS:

AREA/ITEM - FINNED TUBE: m^2 | BARE TUBE: m^2

HEAT EXCHANGED: kJ/h | LMTD (CORRECTED):

TRANSFER RATE - FINNED TUBE | BARE TUBE-SERVICE: CLEAN: $kJ/h.m^2.ºC$

AVAILABLE AREA: m^2 | WEIGHT OF THE BUNDLE: N

2 - OPERATION

TUBE SIDE

FLUID: | DENSITY - LIQUID:

TOTAL FLOW RATE: kg/h | FREEZE POINT: ºC

		INLET	OUTLET	BUBBLE POINT: ºC	POUR POINT: ºC
TEMPERATURE	ºC			THERM. CONDUT. (V) (L):	kJ/kg.ºC@ ºC
LIQUID	kg/h			LATENT HEAT:	kJ/kg
VAPOR	kg/h PM			THERM. CONDUT. (V) (L):	kJ/m.ºC@ ºC
NON-CONDENSABLE	kg/h PM			OPERATION PRESSURE - INLET:	MPa
STEAM	kg/h			ALLOWABLE PRESSURE DROP:	MPa
WATER	kg/h			CALCULATED PRESSURE DROP:	MPa
VISCOSITY (V)(L)	Pa.S			INT. FOULING COEFF.:	$m^2.C.h/kJ$

AIR SIDE

AIR FLOW RATE/ITEM: NORMAL m^3/h | ALTITUDE: m

AIR FLOW RATE/FAN: m^3/h | INLET TEMPERATURE: ºC

STATIC PRESSURE: MPa | OUTLET TEMPERATURE: ºC

FACE VELOCITY: m/s | MIN. AMBIENT TEMP.: ºC

3 - CONSTRUCTION

DESIGN PRESSURE: MPa | TEST PRESSURE: MPa | DESIGN TEMP.: ºC

TUBE BUNDLE		HEADER		TUBES	
DIMENSIONS: m	Nr. ROWS:	TYPE:		MATERIAL:	
Nr./BAYS:		MATERIAL:		OUT. DIAM.:	THICK.: mm
ARRANGEMENT:		Nr. PASSES:	INCL.:	Nr. TUBES/BUNDLE:	LENGTH: m
BUNDLES: ☐ PARAL. ☐ SERIES		PLUGS-TYPE:	MAT.:	PITCH: mm	JOIN. TUBE/TUBESHEET:
BAYS: ☐ PARAL. ☐ SERIES		GASKET MAT.:		FINS	
BUNDLE FRAME MAT.:		CORROSION ALLOWANCE: mm		TYPE:	
MISCELLANEOUS		INLET NOZZLE DIAM.:		MATERIAL:	
FRAME MAT.:	LADDER:	OUTLET NOZZLE DIAM.:		EXTERNAL DIAM.:	mm
PLENUM CH. MAT.:	PLAT.:	PRESSURE RATING:		THICKNESS:	mm
VIBRATION SWITCH:		NOZZLES GASKET:		Nr./INCH:	

4 - MECHANICAL EQUIPMENT

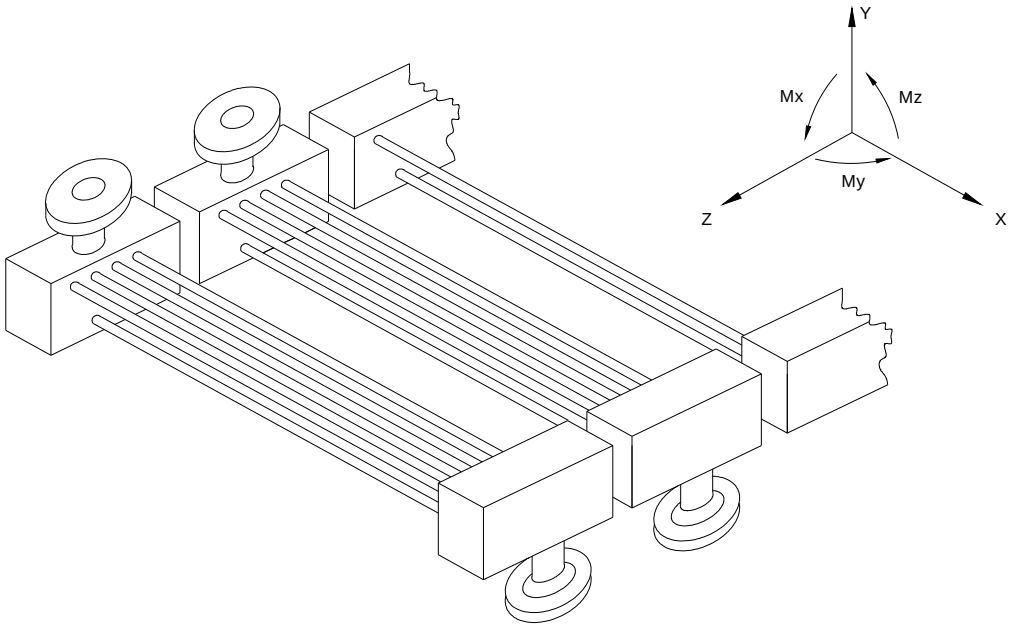
FAN		DRIVER		SPEED REDUCER	
MANUF.:	MODEL:	TYPE:	STANDARD:	TYPE:	
Nr./BAYS:	kW/FAN:	Nr./BAYS:	hp/DRIVER:	Nr./BAYS:	
DIAMETER: m	rpm:	rpm:		MODEL:	
Nr. BLADES:	PITCH: ☐ MAN. ☐ AUTOM.	ENCLOSURE TYPE:		SERVICE CLASS AGMA (kW):	
BLADES MAT.:	ANG.:	VOLT/PHASE/CYCLES: V / / Hz		REDUCTION RATIO:	
HUB MAT.:	NOISE L.: dB(A)	MANUFACTURER:		MANUFACTURER:	

COUPLING	TYPE:	MODEL:	MATERIAL:	MANUFACTURER:

CONTROL	☐ MANUAL ☑ AUTOMÁTICO	☐ LOUVER OPEN. CONTROL	☐ FAN BLADE PITCH	☐ FAN SPEED VAR.
	ACTION ON AIR FAILURE	FAN PITCH: MIN./MAX.	LOUVER: OPEN/CLOSED	FAN SPEED

NOTES:

PETROBRAS	DATA SHEET	Nr.	REV.
			SHEET of
	TITLE: Air Cooler		



ALLOWABLE LOADS

DIRECTION	COOLER FRAME	NOZZLES	
		INLET	OUTLET
Fx (N)			
Fy (N)			
Fz (N)			
Mx (N.m)			
My (N.m)			
Mz (N.m)			

	ITEM		
1	EXTREMITIES WHERE THE TUBE BUNDLES ARE FIXED TO PREVENT MOVEMENT IN DIRECTION X		☐ INLET ☐ OUTLET
2	TUBE BUNDLES WITH FREEDOM TO MOVE IN DIRECTION Z MOVEMENT ALLOWED FOR EXTERNAL BUNDLES IN DIRECTION Z		☑ YES ☐ NO
3	MODIFICATIONS TO ALLOW GREATER MOVEMENTS IN DIRECTION Z ALLOWED MOVEMENTS		mm
4	FRICTION COEFFICIENT OF SLIDING PIECES		mm
5	WEIGHT OF EACH TUBE BUNDLE	EMPTY	kgf
		WATER-FILLED	kgf

INDEX OF REVISIONS	
REV. A and B	
There is no index of revisions.	
REV. C	
Affected Parts	**Description of Alteration**
All	Revised