Date of issue:
February 2026

Affected publication:
IOGP S-710, Supplementary Specification to API Standard 661 Air-cooled Heat Exchangers, First Edition, June 2020

ADDENDUM 1

This addendum (Version 1.01) replaces Edition 1.0 published in June 2020.

NOTE: In addition to the updates listed below, minor editorial/typographical amendments may have been made.

List of updates

Section	Description
2	Normative reference “ASTM A450/A450M" added
7.3.5.8	New NOTE added
10	Subsection replacement of 10.1.5 deleted New subsection 10.2.7 amended
12	New subsection replacement of 12.1 added Deletion of subsections 12.3.1 to 12.3.9 deleted (i.e. API 661 subsections 12.3.1 to 12.3.9 reinstated) New subsection 12.3.15 added

International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-710

February 2026
Version 1.01

ADDENDUM 1 TO FIRST EDITION (JUNE 2020)

Supplementary Specification to API Standard 661 Air-cooled Heat Exchangers

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.01	February 2026	Addendum 1
1.0	June 2020	First Edition

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

Table of Contents

List of Tables

Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of air-cooled heat exchangers in accordance with API Standard 661, Seventh Edition, July 2013 - Reaffirmed, June 2018 for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Specification

It is required to use all of these documents in conjunction with each other when applying this specification, as follows.

This specification is to be applied in conjunction with the supporting data sheet, quality requirements specification (QRS) and information requirements specification (IRS) as follows.

IOGP S-710: Supplementary Specification to API Standard 661 Air-cooled Heat Exchangers

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to API Standard 661, following the API Standard 661 clause structure. Clauses from API Standard 661 not amended by this specification apply as written to the extent applicable to the scope of supply.

Modifications to API Standard 661 defined in this specification are identified as *Add* (add to clause or add new clause), *Replace* (part of or entire clause) or *Delete*.

IOGP S-710D: Data Sheet for Air-cooled Heat Exchangers

The data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-710Q: Quality Requirements for Air-cooled Heat Exchangers

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data sheet or in the purchase order.

IOGP S-710L: Information Requirements for Air-cooled Heat Exchangers

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

The terminology used within this specification and the supporting data sheet, QRS and IRS follows that of API Standard 661 and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser defined requirements (data sheet, QRS, IRS);

d) this specification;

e) API Standard 661.

2 Normative References

Add to section

API STD 660: 2015, *Shell-and-Tube Heat Exchangers*

ASME BPVC Section VIII Division 1: 2019, *Rules for Construction of Pressure Vessels*

ASME BPVC Section VIII Division 2: 2019, *Alternative Rules for Construction of Pressure Vessels*

ASME BPVC Section IX : 2019, *Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators*

ASTM A450/A450M, *Standard Specification for General Requirements for Carbon and Low Alloy Steel Tubes*

IOGP S-619, *Specification for Unfired, Fusion Welded Pressure Vessels*

Replace Section 3 heading with

3 Terms and definitions, acronyms and abbreviations

Add new term

3.34
plenum depth
For forced draft units:
straight vertical distance between bottom of bundle frame (or steam coil frame) and top of fan ring
For induced draft units:
straight vertical distance between bottom of fan ring and top of tube bundle (or top of louver frame)

Add new subsection

3.35 Acronyms and Abbreviations

DN nominal diameter

HBW Brinell hardness

HRC Rockwell hardness, C scale

HV Vickers hardness

NPS nominal pipe size

4 General

4.1

Replace second paragraph with

Pressure components shall comply with the pressure design code, the requirements given in this specification and the requirements given in IOGP S-619.

4.6

Replace first sentence with

The Purchaser shall specify if the service is designated as sour in accordance with NACE MR0175/ISO 15156 or NACE MR0103/ISO 17945.

5 Proposals

5.5

Replace subsection with

A proposal for a design that is not described in this specification, the design code or purchaser documents shall include additional drawings, construction details and a description of design methods for the proposed design.

6 Documentation

6.1 Approval Information

6.1.1

Add to list item f)

including location, dimensions of walkways, platforms, ladders and stairways;

Add new list items u) to bb)

u) recommended spare parts;

v) pickling and passivation;

w) positive material identification;

x) tube expansion into tubesheet;

y) lifting and handling;

z) noise data;

aa) non-destructive examination personnel qualification records;

bb) sub-vendor list.

6.1.2

Replace subsection with

If specified by the Purchaser, the Vendor shall submit details for:

a) gaskets;

b) tube bundle and tube bundle frame;

c) field assembly;

d) all auxiliary equipment and controls including cable trays and junction boxes;

e) electrical and control connections including those of motive and signal air for any pneumatically actuated louvers or fans;

f) structure, walkways, platforms, ladders and stairways;

g) motor suspension assembly including fans, bearings, pulleys, belts, etc.;

h) plenum chamber including plenum beams;

i) fan ring including support;

j) fan screens and guards;

k) header guard.

6.1.3

Replace subsection with

If specified by the Purchaser, the Vendor shall submit the following calculations:

a) calculations required by the pressure design code for design of pressure components, including header boxes, tubes, tube to tubesheet weld joints, inlet and outlet process nozzles and other non-standard pressure boundary components such as swage nozzles;

b) structural calculations to evaluate column reactions for each load type listed in 7.3.3;

c) thermal and hydraulic design calculations;

d) restraint relief calculations in accordance with 7.1.6.1.3;

e) local load analysis due to external forces and moments on nozzles in accordance with 7.1.10.

6.2 Final Records

6.2.2

Add new list items q) and r)

q) shop run-in test report, including all recorded test results;

r) thermal and hydraulic design calculations.

7 Design

7.1 Tube Bundle Design

7.1.1 General

7.1.1.4

Add to subsection

Supports, guides, and spacers in contact with austenitic stainless steel or high nickel alloy tubes, or their fins, shall be aluminum.

7.1.6 Headers

7.1.6.1 General

7.1.6.1.3

Replace first sentence with

The requirement for restraint relief in single- or multi-pass exchangers shall be investigated for the fluid temperature difference between the inlet and outlet of the exchanger for all operating and ambient conditions.

7.1.6.1.6

Add to subsection

For grooved tube-to-tubesheet joints, when the tubesheet holes are recessed to accommodate extension of the unfinned portion of aluminum sleeves for corrosion protection, the recess depth shall be added to the minimum tubesheet thickness.

Replace Table 1 with

Table 1 — Minimum Nominal Thickness of Header Components

Component	Minimum Thickness	
	Carbon or Low-alloy Steel mm (in.)	High-alloy Steel or Other Material mm (in.)
Tubesheet (Tube-to-tubesheet joints without grooves)	19 ($^{3}/_{4}$)	16 ($^{5}/_{8}$)
Tubesheet (Tube-to-tubesheet joints with grooves)	27 (1 $^{1}/_{8}$)	24 (1)
Plug sheet	19 ($^{3}/_{4}$)	16 ($^{5}/_{8}$)
Top, bottom and end plates	12 ($^{1}/_{2}$)	10 ($^{3}/_{8}$)
Removable cover plates	25 (1)	22 ($^{7}/_{8}$)
Pass partition plates and stay plates	12 ($^{1}/_{2}$)	6 ($^{1}/_{4}$)
NOTE The thickness indicated for any carbon or low-alloy steel component includes a corrosion allowance of up to 3 mm ($^{1}/_{8}$ in.). The thickness indicated for any component of high-alloy steel or other material does not include a corrosion allowance. Tubesheet thickness for tube-to-tubesheet joints with grooves is a minimum and may have to be further increased when welding in combination with grooves.		

7.1.6.1.7

Add to subsection

Partition plates shall be provided with a minimum of two holes for drain or vent of 5 mm ($^{3}/_{16}$ in.) diameter.

Add to subsection

Drain holes shall be at least one nozzle internal diameter away from the process nozzle centerline.

Add new subsection

7.1.6.1.9

One grounding lug shall be provided on each header.

7.1.6.2 Removable Cover Plate and Removable Bonnet Headers

7.1.6.2.1

Add to subsection

Cover plate headers shall not be used where the tube side design pressure is above 3000 kPag (435 psig) or in hydrogen service.

7.1.6.2.2

Replace first sentence with

Removable bonnet type headers shall not be used.

7.1.6.2.3

Replace first sentence with

Bolted joints shall be designed using through bolts with confined gaskets as shown in Figure 4 a) or Figure 4 b).

Delete second sentence

Replace fourth sentence with

For the gasket types specified in Table A.3, the gasket contact surface finish of header box flanges, cover plates and pass partition plates shall be in accordance with Table A.4.

Delete fifth sentence

Delete sixth sentence

7.1.6.2.4

Replace subsection with

Jackscrews shall be provided at the cover periphery to facilitate dismantling.

7.1.6.2.7

Replace subsection with

The minimum nominal diameter of through-bolts shall be 20 mm (¾ in.).

7.1.8 Gaskets

7.1.8.4

Replace first sentence with

For the joint type shown in Figure 4 a), cover plate gaskets shall be as specified in the data sheet.

7.1.8.5

Replace first sentence with

For the joint type shown in Figure 4 b), cover plate gaskets shall be as specified in the data sheet.

7.1.8.6

Replace subsection with

The joint type shown in Figure 4 c) shall not be used.

7.1.8.7

Replace subsection with

The minimum width of the perimeter portion of removable cover plate gaskets shall be 13 mm ($^1/_2$ in.).

Add to subsection

The minimum width of the gasket at the pass partition plate groove for removable type headers shall be 10 mm ($^3/_8$ in.).

7.1.9 Nozzles and Other Connections

7.1.9.2

Replace subsection with

The minimum nozzle size shall be DN 40 (NPS $1^1/_2$).

7.1.9.6

Add to subsection

The minimum nominal thickness for austenitic stainless steel and other high alloy nozzles shall be equal to schedule 80S.

7.1.9.8

Replace subsection with

Flanged connections shall be one of the following types:

a) a forged, integrally flanged weld neck;

b) a pipe welded to a forged weld neck flange; or

c) a seamless transition piece (for swage nozzle) attached to a forged weld neck flange.

7.1.9.10

Replace subsection with

Threaded nozzles and connections shall not be used.

Add new subsection

7.1.9.22

Set-in nozzles shall be flush with the inside surface of the header box plates.

Add new subsection

7.1.9.23

The inside corners of all set-in nozzles shall be rounded to a minimum radius of 3 mm ($^{1}/_{8}$ in.).

Add new subsection

7.1.9.24

Nozzles shall be self-reinforced without the use of reinforcing pads.

Add new subsection

7.1.9.25

The use of stay bars for added mechanical strength or reinforcement of nozzles shall not be allowed.

7.1.11 Tubes

7.1.11.7

Add to subsection

Fin selection temperature shall be in accordance with Table A.1.

Add to subsection

For extruded fins, the thickness of the remaining sleeve of aluminum between fins shall be at least 0.51 mm (0.02 in.).

7.1.11.8

Add to subsection

The minimum fin tip thickness for integral or extruded fins shall be 0.2 mm (0.008 in.).

Add to subsection

The tolerance allowed on the outer diameter of the fin shall be ±1 mm (0.04 in.).

Add new subsection

7.1.11.14

Fin density undertolerance shall not exceed 3 %.

Add new subsection

7.1.11.15

The minimum gap between fins on adjacent tubes shall be 6.35 mm ($^1/_4$ in.).

Add new subsection

7.1.11.16

The unfinned area of the extruded finned tube ends shall be protected with one of the following:

— metallizing;

— sleeves; or

— coating.

Add new subsection

7.1.11.17

The metallizing of the unfinned area of stainless steel or other high alloy tube ends shall be aluminium.

Add new subsection

7.1.11.18

Coating or metallizing of the unfinned area of the tube ends shall extend up to a maximum of 3 mm ($^1/_8$ in.) inside the tubesheet to avoid interference with expansion of the tubes.

7.2 Air-side Design

7.2.1 General

7.2.1.3

Replace definition of h with

h is the height above grade to the bottom of the fan ring inlet for forced draft type units, or to the bottom of the tube bundle side frames for induced draft type units, expressed in meters (feet);

7.2.1.8

Replace subsection with

Mechanical components and instruments shall be designed and manufactured based on design exposure temperatures for each operating mode (start-up, normal operation, shutdown, loss of power, stagnated air flow, one fan inoperable, etc.).

Add new subsection

7.2.1.9

For induced draft units, the maximum exposure temperature for fans and other mechanical components (e.g. bearings) shall be based on the fan nearest to the process inlet end of the heat exchanger.

7.2.3 Fans and Fan Hubs

7.2.3.4

Add to subsection

The plenum depth shall not be less than 915 mm (36 in.).

Add to subsection

For induced draft exchanger designs, the tip of the fan blade shall be located no closer than 35 % of the fan diameter from the center of the upper tube row of the bundle.

7.2.3.9

Add to subsection

A center hub seal disc shall be installed to minimize reverse air flow at the hub.

Add new subsection

7.2.3.17

For forced draft units, the fan ring inlet shall be conical or rounded (e.g. inlet bell).

Add new subsection

7.2.3.18

Glass-reinforced plastic blades shall be provided with ultraviolet protection.

Add new subsection

7.2.3.19

Induced draft fan mountings and bearing arrangements shall be designed to allow fan and hub removal and re-installation without disturbing the tube bundle.

7.2.4 Fan Shafts and Bearings

7.2.4.2

Add to subsection

An external conical slinger shall be fitted to the fan shaft if the bearing housing is not designed to prevent water ingress.

Add new subsection

7.2.4.7

The upper fan shaft (radial) bearing shall be a single row ball bearing with metal retainer.

Add new subsection

7.2.4.8

The lower fan shaft (thrust) bearing shall be a double-row spherical roller bearing in a flange block housing.

Add new subsection

7.2.4.9

A grease release shall be provided for all bearing housings.

7.2.5 Lubrication Facilities

Add to subsection

One greasing line per fan shaft bearing injection point shall be provided.

7.2.6 Fan Guards

7.2.6.1

Replace subsection with

Removable steel fan guards shall be provided.

Add new subsection

7.2.6.10

Fan guards shall have one hinged section to provide maintenance access.

7.2.7 Drivers

7.2.7.2 Electric Motor Drivers

7.2.7.2.9

Replace subsection with

A self-actuating braking device shall be installed on the fan shaft to prevent reverse rotation of an idle fan.

7.2.8 Couplings and Power Transmissions

7.2.8.2 Belt Drives

7.2.8.2.1

Replace subsection with

Belt drives shall be high-torque, anti-static, positive-drive.

7.2.8.2.2

Replace subsection with

Belt drive assemblies shall be suspended from the bundle side frame.

7.2.8.2.9

Replace subsection with

High-torque, positive-drive belts shall have a minimum service factor of 2.0 based on driver-rated power.

7.2.8.2.13

Replace subsection with

Drive belt materials shall be selected for an exposure temperature of 60 °C (140 °F) and minimum atmospheric temperature.

7.2.8.3 Gear Drives

7.2.8.3.2

Replace subsection with

Where gear drives are used, the motor and the gearbox shall be mounted on a common structure.

7.2.8.4 Mechanical Power Transmission Guards

Add new subsection

7.2.8.4.4

The materials selected for mechanical transmission components and transmission guards shall be a non-sparking combination.

7.2.9 Vibration Cut-out Switches

7.2.9.1

Replace subsection with

Vibration control devices (e.g. double-throw, two-contact, vibration cut-out switch, vibration transmitter, accelerometer or a combination of these) shall be mounted on each fan driver unit support structure in a direction to measure radial vibration.

7.2.10 Louvers

7.2.10.16

Replace subsection with

For automatic pneumatic control, a positioner shall be provided at each actuator.

7.2.10.25

Add to subsection

All linkage joints and bearings shall be sealed or self-lubricating.

7.2.11 Screens

7.2.11.2 Insect/lint Screens

7.2.11.2.1

Add to subsection

Screens shall not impede the actuator or louver stroke.

7.2.11.3 Hail Screens

7.2.11.3.1

Add to subsection

Screens shall not impede the actuator or louver stroke.

7.3 Structural Design

7.3.1 General

Add new subsection

7.3.1.7

Grounding (earthing) lugs shall be provided to maintain earthing continuity of the continuous assembly.

7.3.5 Mechanical Access Facilities

7.3.5.3

Replace subsection with

All platforms and walkways, including header access walkways, shall have a clear width of 915 mm (36 in.).

7.3.5.8

Add new NOTE

NOTE If the air outlet temperature at design conditions exceeds 90 °C (195 °F) for forced-draught heat exchangers, evaluation of the need for personnel heat protection shielding along the header-box platforms is warranted.

Add new subsection

7.3.5.9

For forced draft units, the minimum vertical clearance between the fan ring inlet and access platform or grade (for grade-mounted coolers) shall be 2.1 m (7 ft).

Add new subsection

7.3.5.10

For induced draft units, the minimum vertical clearance between the tube bundle frame and access platform or grade (for grade mounted coolers) shall be 2.1 m (7 ft).

8 Materials

8.1 General

8.1.2

Replace subsection with

Cast iron shall not be used for pressure components.

Add new subsection

8.1.7

Corrosion-resistant lining or cladding shall not be applied for plug type headers.

8.3 Headers

8.3.3

Replace subsection with

8.3.3.1

Where austenitic stainless steel tube access header plugs are used with an austenitic stainless steel plugsheet, the minimum difference in hardness between the plug and plugsheet shall be 30 brinell.

8.3.3.2

Tube access header plug materials other than those in 8.3.3.1 shall be of same nominal composition as the header material.

8.3.3.3

Cast iron shall not be used for plug material.

8.5 Other Components

8.5.1

Add to subsection

For offshore installations, aluminium fin material shall be marine grade (e.g. aluminium alloys 5005 and 1060).

Add new subsection

8.5.7

Fan drive sheaves shall be metallic.

Add new subsection

8.5.8

Welded tubes shall be eddy-current tested in the finished condition over their full length.

9 Fabrication of Tube Bundle

9.1 Welding

9.1.1 General

9.1.1.1

Replace subsection with

Welding and welder qualification shall be performed in accordance with the requirements of the design code, IOGP S-619, the air-cooled heat exchanger data sheet and this specification.

9.2 Postweld Heat Treatment

9.2.3

Add to end of subsection

or NACE MR0175/ISO 15156.

9.3 Tube-to-Tubesheet Joints

9.3.2 Tube-hole Grooving

9.3.2.1

Replace subsection with

All tubesheet holes for grooved joints in tubesheets shall be machined with two grooves of 3 mm ($^{1}/_{8}$ in.) wide and 0.4 mm ($^{1}/_{64}$ in.) deep.

9.3.2.3

Replace subsection with

9.3.2.3.1

The edge of the groove shall be located at a minimum of 6 mm ($^{1}/_{4}$ in.) plus the corrosion allowance from the process face of the tubesheet for expanded only tube-to-tubesheet joints.

9.3.2.3.2

The edge of the groove shall be located at a minimum of 9 mm ($^{3}/_{8}$ in.) including the corrosion allowance of up to 3 mm ($^{1}/_{8}$ in.) from the edge of the weld for welded and expanded tube-to-tubesheet joints.

9.3.2.3.3

Grooves shall be located a minimum of 6 mm ($^{1}/_{4}$ in.) from the air-side face of the tubesheet or edge of the recess (see 7.1.6.1.6).

9.3.2.3.4

The minimum distance between the edges of the grooves shall be 6 mm ($^{1}/_{4}$ in.).

9.3.3 Expanded Tube-to-Tubesheet Joints

9.3.3.1

Replace subsection with

Tubes shall be expanded into the tubesheet for a length equal to the tubesheet thickness, starting 6 mm ($^1/_4$ in.) from the weld edge or 3 mm ($^1/_8$ in.) from the tube-side face of the tubesheet and proceeding up to 3 mm ($^1/_8$ in.) from the air-side face of the tubesheet or edge of the recess (see 7.1.6.1.6), but not beyond the air-side face of the tubesheet.

9.3.3.3

Replace subsection with

The ends of the tubes shall extend at least 1.5 mm ($^1/_{16}$ in.) and not more than 5 mm ($^3/_{16}$ in.) beyond the process-side face of the tubesheet.

Add new subsection

9.3.3.4

For roller-expanded tube-to-tubesheet joints, the maximum tube wall thickness reduction shall be in accordance with API 660, Table 6.

Add new subsection

9.3.3.5

For roller expanded tube-to-tubesheet joints, the tube wall thickness reduction shall be checked for a minimum of 2 % of the joints per tube bundle, with a minimum of five joints.

9.3.4 Welded Tube-to-Tubesheet Joints

9.3.4.3

Replace subsection with

If a strength welded tube-to-tubesheet joint is specified, the qualification of the weld shall be in accordance with the requirements of ASME Section IX, QW-193 or equivalent, and the following additional requirements:

a) weld design and detail in accordance with ASME Code, Section VIII, Division 1, UW-20 with geometry as shown in Figure UW-20.1 or equivalent;

b) a minimum of three tensile pull-tests performed on the qualification test coupon whenever it cannot be proven by calculation that the strength of the weld is greater than the axial strength of the tube.

9.4 Gasket Contact Surfaces

9.4.3

Replace subsection with

Plug gasket contact surfaces shall be machined to a finish of average roughness between 0.8 µm and 3.2 µm (32 µin. and 125 µin.).

10 Inspection, Examination, and Testing

10.1 Quality Control

10.1.1

Replace subsection with

If 100 % volumetric examination is specified, the complete length of all pressure retaining welds including end-closure weld and nozzle to header welds shall be radiographically or ultrasonically examined.

10.1.2

Delete second sentence

10.1.6

Replace subsection with

If set-on connections are used, the following non-destructive testing shall be performed prior to nozzle fit-up, with zero defect acceptance criteria:

a) liquid penetrant or magnetic particle examination of the surface of the through-wall cut;

b) lamination check by 100 % ultrasonic examination of the base plate to 100 mm (4 in.) around the nozzle opening.

Replace Table 12 with

Table 12 — Maximum Weld Hardness

Material	Maximum Weld Hardness
Carbon steel	225 HBW
Chromium steel (up to 3 % Cr)	225 HBW
Chromium steel (5 % Cr to 17 % Cr)	241 HBW
Duplex stainless steel (22 % Cr)	320 HV10 or 28 HRC
Super duplex stainless steel (25 % Cr)	350 HV10 or 32 HRC
NOTE These hardness values are for general services. More stringent hardness testing and acceptance criteria can be required for special services (e.g. sulfide stress cracking or other types of environmental cracking services as specified in NACE standards).	

Add new subsection

10.1.15

Prior to welding, a magnetic-particle or liquid-penetrant examination shall be performed on all edges and plate openings prepared for welding with defects cleared to sound metal.

10.2 Pressure Test

Add new subsection

10.2.7

If not specified in the design code, the primary membrane stress in any pressure containing component shall not exceed 95 % of the material minimum yield strength during hydrostatic testing.

10.3 Shop Run-in

Replace subsection with

If specified as required, the minimum extent of the shop run-in test shall be as follows:

a) A shop run-in test of the driver, drive assembly and fan for shop assembled units.

b) One bay tested for each ten identical bays in service with a minimum of one bay per identical bay.

c) Performed on assembled bays including the completed tube bundle/header box assembly, louvers (if applicable), plenums, fan rings, fans, drivers, drive assemblies, motor mounts and support columns.

d) Measurement and recording in accordance with the following:

   1) check and record the fan tip clearances;

   2) set and record the fan blade pitch as per the design blade angle (± 0.5° blade angle);

   3) run the motors and fans at the design speed for a minimum of 15 minutes, recording the motor voltage, motor amperage, fan speed, noise levels and vibration levels (see 7.3.2.1);

   4) air flow measurements taken for each fan (see Annex D).

11 Preparation for Shipment

11.1 General

11.1.3

Replace subsection with

Exposed flanged connection gasket surfaces shall be protected as follows.

a) Connections with permanent blind flanges or covers: fully bolted with service gaskets, stud bolts and nuts.

b) Connections without permanent blind flanges: protected with a 6 mm ($^{1}/_{4}$ in.) minimum thickness metallic cover and 1.5 mm ($^{1}/_{16}$ in.) thick composition or neoprene gaskets secured to the flange with a minimum of four bolts.

Add new subsection

11.1.6

Finned tube surfaces shall be protected with exterior grade plywood covers unless hail screens or louvers are provided.

Add new subsection

11.1.7

Shipping restraints (e.g. bolts and spacers) to be removed shall be clearly marked with bright, contrasting paint.

11.2 Surfaces and Finishes

11.2.3

Replace subsection with

Pressure components and non-galvanized structural steel shall be blast-cleaned.

Add to subsection

Pressure components and non-galvanized structural steel shall be coated.

12 Supplemental Requirements

12.1 General

Replace subsection with

The supplemental requirements of Section 12 shall apply if one or more of the following conditions exist:

a) design pressure of at least 10,340 kPa (ga) (1500 psig);

b) box header plate thickness equal to or greater than 50 mm (2 in.);

c) carbon steel in high-severity SSC service;

d) toxic service.

12.2 Design

12.2.2

Replace first sentence with

Tube-to-tubesheet joints shall be strength welded and expanded.

12.3 Examination

12.3.1

Delete "if the thickness exceeds 50 mm (2 in.)" from sentence

12.3.12

Delete subsection 12.3.12

12.3.13

Delete subsection 12.3.13

Add new subsection

12.3.15

Seamless and welded tubes shall be hydrostatically tested by the tube manufacturer in accordance with ASTM A450 or an accepted alternative in addition to required non-destructive electric testing.

Annex B
(informative)
Checklist and Data Sheets

Replace first paragraph with

IOGP S-710D contains the information necessary for the description and design of air-cooled heat exchangers for petroleum and natural gas services.

Delete second paragraph

Delete third paragraph

Delete fifth paragraph

Delete Air-cooled Heat Exchanger Checklist

Delete Air-cooled Heat Exchanger Data Sheet (SI Units)

Delete Air-cooled Heat Exchanger Data Sheet (US Customary Units)

International Association of Oil & Gas Producers

IOGP Headquarters

Level 6, 3 Moorgate Place, London, EC2R 6EA, United Kingdom
T: +44 20 4570 6879
E: reception@iogp.org

IOGP Europe

T: +32 2 882 16 53
E: reception-europe@iogp.org