

Rotating Control Devices

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Contents

	Page
1 Scope	1
2 Normative References	6
3 Terms, Definitions, Acronyms, and Abbreviations	6
3.1 Terms and Definitions	6
3.2 Acronyms and Abbreviations	10
4 Design Requirements	11
4.1 Applications	11
4.2 Size Designation	11
4.3 Service Conditions	12
4.4 Equipment-specific Design Requirements	13
4.5 Design Validation	15
4.6 Documentation	16
4.7 Design Validation Requirements	16
4.8 Operating Manual Requirements	26
5 Material Requirements	27
6 Welding Requirements	27
7 Quality Control Requirements	27
7.1 General	27
7.2 Measuring and Testing Equipment	27
7.3 Quality Control Personnel Qualifications	27
7.4 Quality Control Requirements for Equipment and Parts	27
7.5 Quality Control Requirements for Specific Equipment and Parts	27
7.6 Factory Acceptance Tests	28
7.7 Quality Control Records Requirements	30
8 Marking Requirements	32
8.1 General	32
8.2 Types of Identification Stamping	32
8.3 Specific Codification Requirements of Equipment	33
9 Storing and Shipping	34
9.1 Storing for Periods of Greater than 30 Days	34
9.2 Shipping	35
Annex A (informative) Use of API Monogram by Licensees	36
Annex B (informative) Service Application Testing	37
Annex C (Informative) Purchasing Guidelines for Rotating Control Devices	45
Annex D (Normative) Failure Reporting	47
Bibliography	48

Contents

	Page
Figures	
1	Typical Surface Stack illustrating an Active Rotating Control Device System 2
2	Typical Surface Stack illustrating a Passive Rotating Control Device System 3
3	Typical Surface Stack illustrating a Hybrid Rotating Control Device System..... 4
4	Offshore RCD System Installed Below the Tension Ring and above the Subsea BOP..... 5
B.1	SAL Test Mandrel..... 39

Tables

1	Temperature Ratings for Metallic Materials 12
2	Ratings for Nonmetallic Materials 12
3	Design Validation 17
4	Acceptable Scaling Practices for Design Validation..... 18
5	FAT Requirements 28
6	Marking Requirements and Locations 33
7	Non-metallic Component Marking Code 34
B.1	Fluid Specifications 38
B.2	Service Application Level-Test Variables 40

Rotating Control Devices

1 Scope

This specification is developed to provide for the safe and functionally interchangeable rotating control devices (RCDs) used in air drilling, drilling operations for oil and gas, and in geothermal drilling operations.

Technical content provides requirements for design, performance, materials, testing and inspection, welding, marking, handling, storing, and shipping. This specification does not apply to field use or field-testing of RCDs.

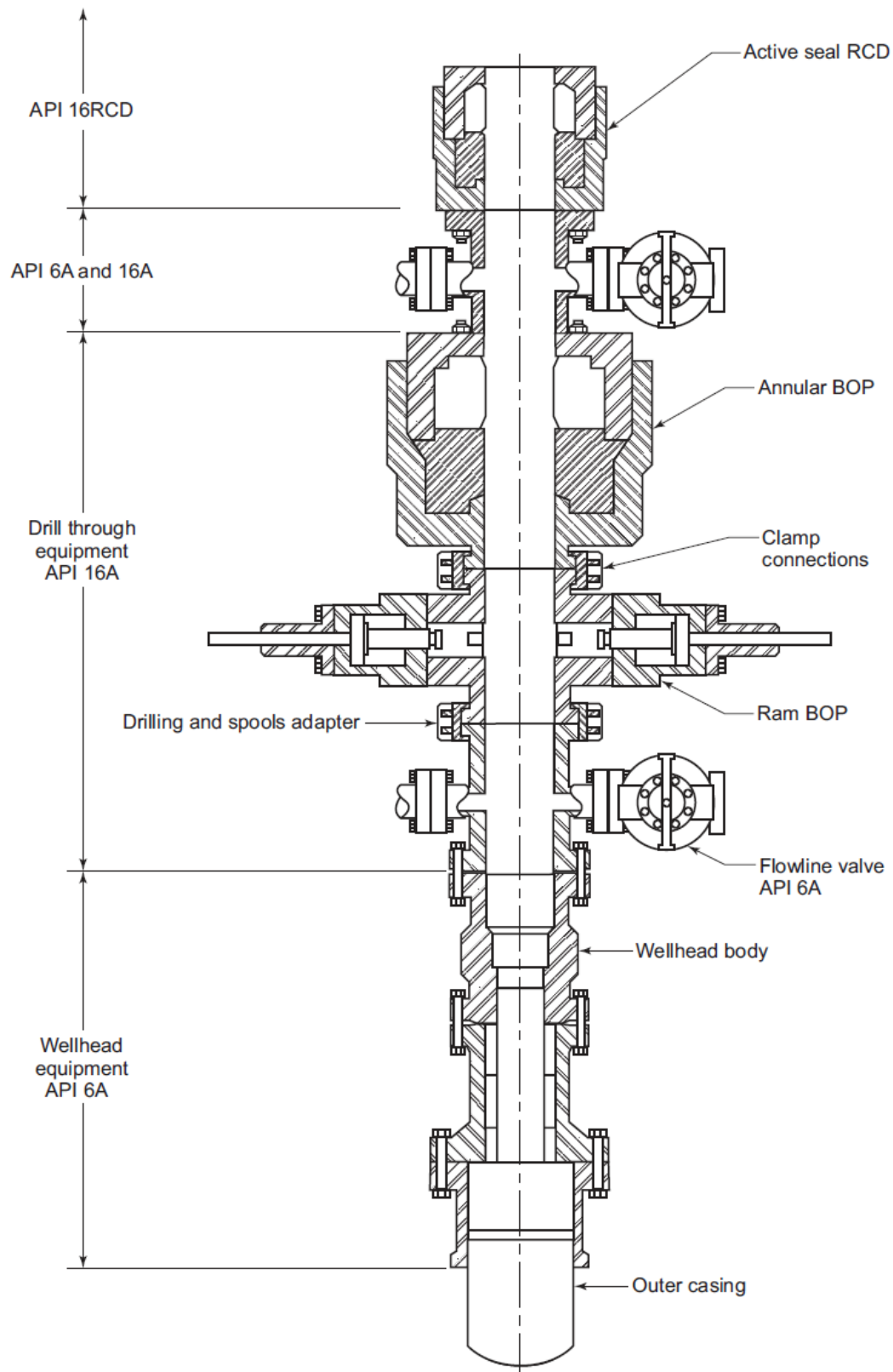


Figure 1—Typical Surface Stack illustrating an Active Rotating Control Device System

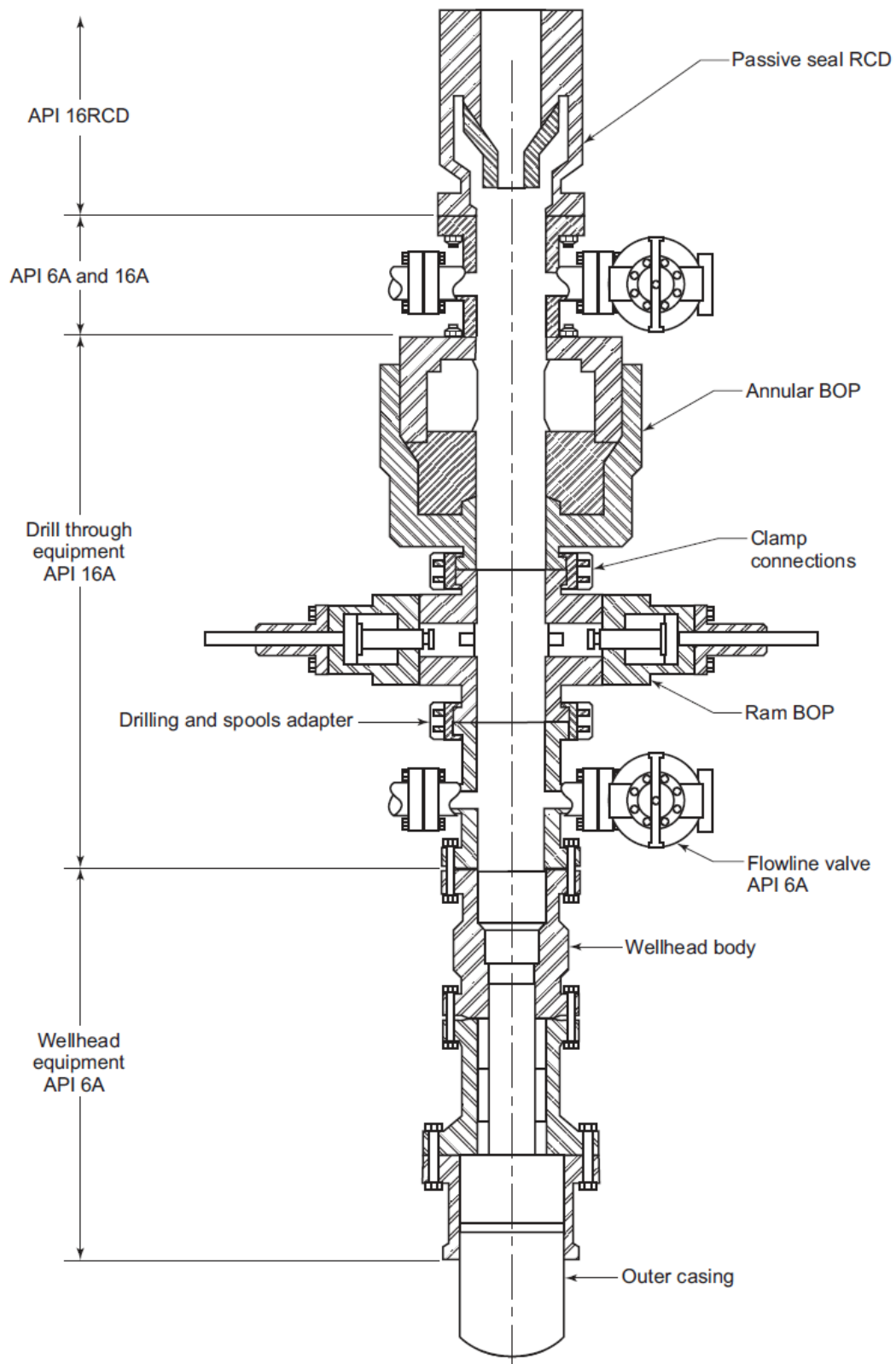


Figure 2—Typical Surface Stack illustrating a Passive Rotating Control Device System

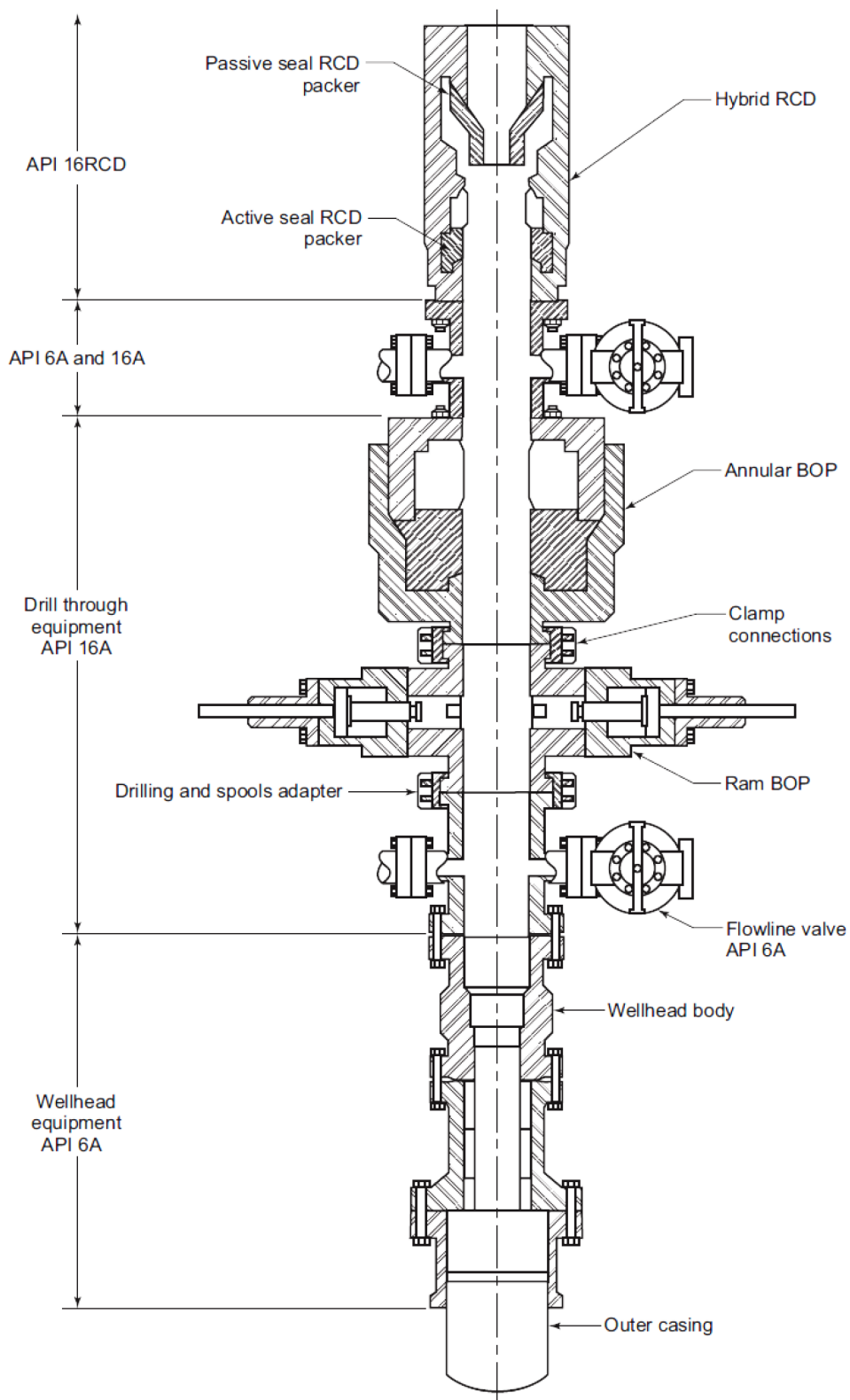


Figure 3—Typical Surface Stack illustrating a Hybrid Rotating Control Device System

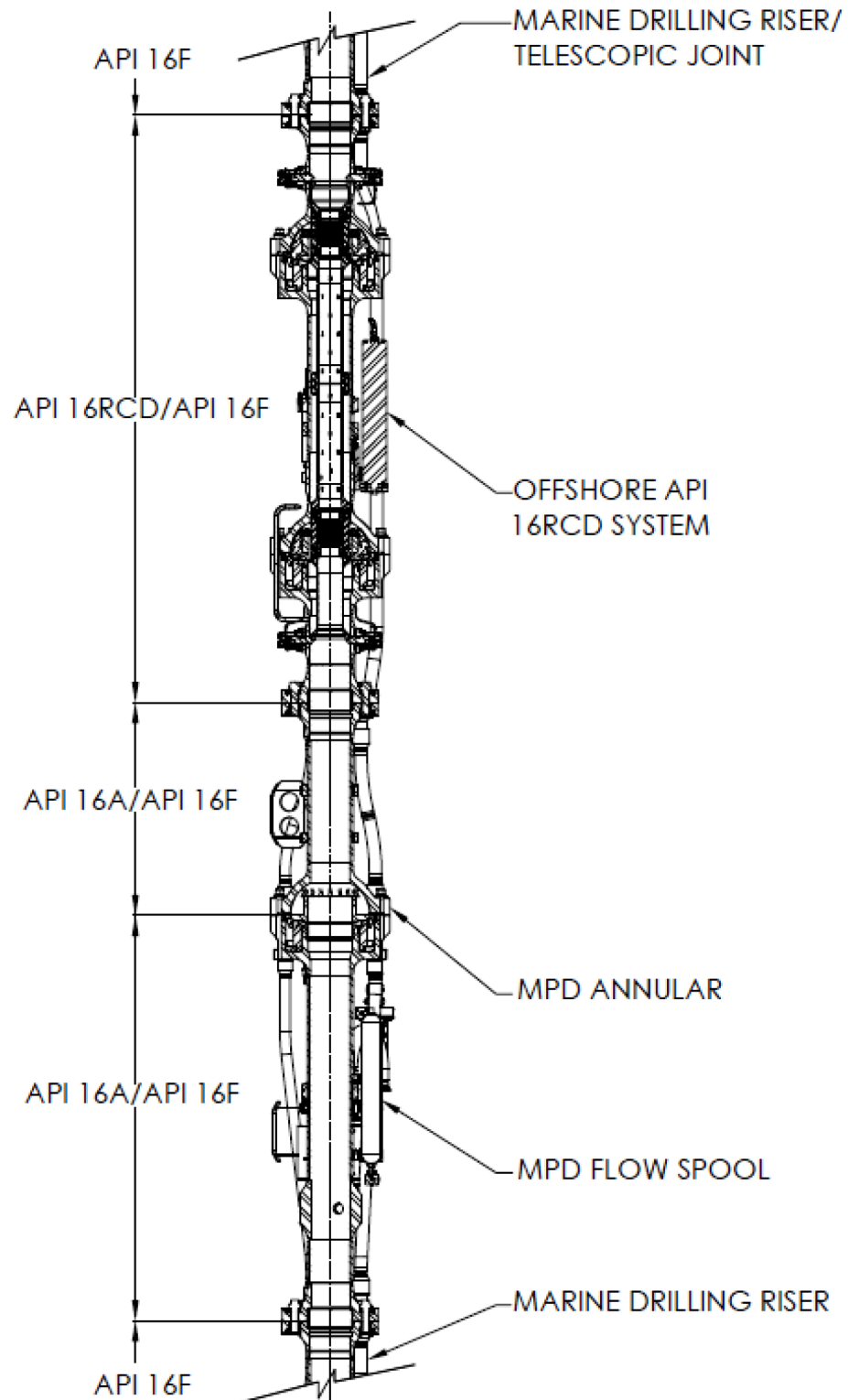


Figure 4—Offshore RCD System Installed Below the Tension Ring and above the Subsea BOP

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Specification 6A, *Specification for Wellhead and Tree Equipment*

API Specification 16A, *Specification for Drill Through Equipment*

API Technical Report 6AF2, *Technical Report on Capabilities of API Integral Flanges Under Combination of Loading—Phase II*

NACE,¹ MR0175/ISO ² 15156 (all parts), *Petroleum and natural gas industries—Materials for use in H₂S-containing environments in oil and gas production*

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

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

3.1.1

acceptance criteria

Defined limits placed on characteristics of materials, products, or services.

3.1.2

active RCD system

An RCD system wherein external force is supplied to maintain the seal between the seal element and the drill pipe.

3.1.3

body

An assembly of equipment between end and outlet connectors that contains wellbore pressure, including the sealing assembly latching mechanism.

NOTE A “body” is sometimes referred to as a “shell” or “housing”.

3.1.4

bolting

All threaded fasteners, including studs, tap-end studs, double-ended studs, headed bolts, cap screws, screws, and nuts.

3.1.5

bore protector

Replacement for the seals or packing elements for protection of the inner bore of RCD, to be installed when pressure control is not required.

3.1.6

bore through the sealing assembly

Minimum inside diameter through the sealing assembly.

¹ NACE International, 1440 South Creek Drive, Houston, Texas 77084-4906, www.nace.org.

² International Organization for Standardization, Chemin de Blandonnet 8, CP 401 - 1214 Vernier, Geneva, Switzerland, www.iso.org.

3.1.7**bore through the body**

Minimum inside diameter through the RCD body, including the bottom connector.

3.1.8**clamp**

Device with internal angled shoulders used to fasten mating hubs.

3.1.9**closure bolting**

Threaded fasteners used to assemble wellbore pressure-containing parts or end and outlet connectors.

3.1.10**conformance****conform**

Fulfillment of specified requirements in every detail.

3.1.11**corrosion resistant ring groove**

Ring grooves lined with a corrosion-resistant weld overlay to improve service life.

3.1.12**blind connector**

End or outlet connector with no center bore, used to completely close off a connection.

3.1.13**data acquisition system**

System for storing or providing permanent copies of test information, such as strip chart recorders, circular chart recorders, computer systems, or a combination thereof.

3.1.14**date of manufacture**

Date of manufacturer's final acceptance of finished equipment.

3.1.15**dynamic pressure rating**

Maximum pressure rating while including rotation of the drill string at a given RPM.

3.1.16**end connector**

Flanges (studded or open face), hub connectors or other end connector which are used to join together equipment and are integral to the equipment.

3.1.17**equipment**

Any single completed unit that can be used for its intended purpose without further processing or assembly.

3.1.18**flange**

Protruding rim, with holes to accept bolts and having a sealing mechanism, used to join pressure-containing equipment together by bolting one flange to another.

3.1.19**full penetration weld**

A weld that extends throughout the complete wall section of the joined parts.

3.1.20**hub**

Protruding rim with an external angled shoulder and a sealing mechanism used to join pressure-containing equipment.

3.1.21**hybrid RCD system**

A rotating control device (RCD) that combines a passive RCD system with an active RCD system.

3.1.22**hydraulic operating chamber**

Any internal or integral cavity of an RCD that is used to contain a hydraulic pressure.

3.1.23**hydraulic operating system rated working pressure**

Maximum hydraulic pressure at which the equipment is designed to operate.

3.1.24**hydraulic operating system recommended operating pressure**

Manufacturer's recommended operating pressure.

3.1.25**integral**

Parts which are joined by the forging, casting, or welding process.

3.1.26**leakage**

Visible passage of the pressurized fluid from the inside to the outside of the pressure containment area of the equipment being tested.

3.1.27**other end connector****OEC**

Connectors that are not specified in an API dimensional specification, including API flanges and hubs with non-API gasket preparations and manufacturer's proprietary connectors.

3.1.28**packing element**

Sealing component(s) between the rotating control device and the drill string.

3.1.29**part**

Individual piece used in the assembly of a single equipment unit.

3.1.30**passive RCD system**

RCD system wherein no external force is supplied to maintain the seal between the seal element and the drill pipe.

3.1.31**pressure-containing part(s) or member(s)**

Parts exposed to wellbore fluids whose failure to function as intended would result in a release of wellbore fluid to the environment.

EXAMPLES Bodies, sealing assemblies.

3.1.32**pressure-controlling part(s) or member(s)**

Parts intended to control or regulate the movement of wellbore fluids.

EXAMPLES Packing elements, seats with a pressure-containing member or part(s).

3.1.33**pressure-retaining part(s) or member(s)**

Parts not exposed to wellbore fluids whose failure to function as intended would result in a release of wellbore fluid to the environment.

EXAMPLES Closure bolts and RCD housing clamps.

3.1.34**rated working pressure**

Maximum internal pressure that the equipment is designed to contain or control, or both.

NOTE For an RCD, the maximum internal pressure that the equipment is designed to contain or control, or both, depends on the operation: dynamic—pipe rotating, stripping—pipe reciprocating or tripped but not rotating and static—no pipe movement.

3.1.35**RCD housing clamp**

Device used to fasten and lock mating RCD body components.

3.1.36**rotating control device****RCD**

Drill-through equipment designed to allow the rotation of the drill string and containment of pressure using seals or packing elements that seal against the drill string (drill pipe, casing, or other drill string components).

3.1.37**rotating speed rating**

Maximum rotating speed specified at a given pressure for a specific pipe size as defined by the manufacturer.

3.1.38**sealing assembly**

An interchangeable, operationally replaceable subcomponent of an RCD that, once inserted into the RCD body, provides primary pressure containment against the drill string (drill pipe, casing, or other drill string components) while allowing for rotation.

NOTE The sealing assembly may include rotating or non-rotating components.

3.1.39**service application level****(SAL)**

Operational service conditions to which RCDs would be exposed.

3.1.40**service conditions**

Service conditions refer to classifications for pressure, temperature, and wellbore fluids listed in [4.2](#) for which the equipment is designed.

3.1.41**stabilized <pressure testing>**

When the initial pressure decline rate decreases to within the manufacturer's specified rate.

NOTE This pressure decline can be caused by such things as changes in temperature, setting of elastomer seals, or compression of trapped air in the equipment being tested.

3.1.42

stabilized <temperature testing>

When the initial temperature fluctuations decrease to within the manufacturer's specified range.

NOTE This temperature fluctuation can be caused by such things as mixing of different temperature fluids, convection, or conduction.

3.1.43

static pressure rating

Maximum design validation pressure of a complete RCD with a new element that the equipment is designed to control with no pipe movement.

3.1.44

stress relief

Controlled heating of material to a predetermined temperature for the purpose of reducing any residual stresses.

3.1.45

stripping

Adding or removing pipe from a pressured wellbore while controlling flow from the wellbore.

3.1.46

stripping pressure rating

Maximum pressure when reciprocating or stripping the drill string for a specific packing element.

3.1.47

studded connectors

Connectors in which thread-anchored studs are screwed into tapped holes.

3.1.48

volumetric nondestructive examination

Examination for internal material defects by radiography, acoustic emission, or ultrasonic testing.

3.1.49

yield strength

Stress level measured at room temperature, expressed in pounds per square in. (kg/m²) of loaded area, at which material plastically deforms and will not return to its original dimensions when the load is released.

NOTE Yield strengths specified in this standard are considered as being the 0.2 % yield offset strength per ASTM A370.

3.2 Acronyms and Abbreviations

For the purposes of this document, the following acronyms and abbreviations apply.

CRA	corrosion-resistant alloy
ID	inside diameter
LP	liquid penetrant
MP	magnetic particle
NDE	nondestructive examination
OD	outside diameter
OEC	other end connector
PQR	procedure qualification record

QTC	qualification test coupons
RCD	rotating control device
SAL	service application level

4 Design Requirements

4.1 Applications

4.1.1 Equipment

An RCD is considered a complete system when comprised of operationally interchangeable subcomponents that allows for rotation and axial movement of drill string while simultaneously containing wellbore pressure. Specific equipment covered by this specification includes but not limited to:

- a) Active RCD System, Passive RCD System, and Hybrid RCD System (see [Figure 1](#), [Figure 2](#), [Figure 3](#), and [Figure 4](#)) illustrate a surface BOP stack-up with each type of RCD installed);
- b) RCD sealing assemblies including metallic and non-metallic parts;
- c) RCD packing elements (active and passive types);
- d) RCD housing including clamps or locking mechanisms.

4.1.2 Interchangeability

A complete RCD comprises a core component (i.e. body) and interchangeable, operationally replaceable subcomponents (i.e. sealing assembly) that conform with this specification.

NOTE At the discretion of the OEM, a single RCD body may be used with different sealing assembly(s) having various size designations or service conditions, or both.

4.2 Size Designation

4.2.1 API Designated Size

RCDs shall be identified by the following:

- a) end and outlet connector(s);
- b) bore through body;
- c) minimum restricted inside diameter (ID) with packing element(s) in place;
- d) bore through sealing assembly, if different from minimum restricted ID;
- e) drift diameter with bore protector installed.

4.2.2 End-to-End Dimensions

The end-to-end dimensions for RCDs shall be the overall height from the bottom face of the bottom connector to the top face of the top flange connector, if applicable. All other dimensions shall be per manufacturer's specification.

4.3 Service Conditions

4.3.1 Pressure Ratings

The static pressure rating, the dynamic pressure rating, and the stripping pressure rating shall be specified by the manufacturer and validated by this specification. All pressure ratings shall apply to new packing elements and shall not exceed the pressure rating of the lowest rated connector exposed to well bore pressure.

4.3.2 Temperature Ratings

4.3.2.1 Metallic Materials

Equipment shall be designed for metallic parts to operate within the temperature ranges shown in [Table 1](#).

Table 1—Temperature Ratings for Metallic Materials

Classification	Operating Range °F (°C)
T-75	–75 (–59) to 250 (121)
T-20	–20 (–29) to 250 (121)
T-0	0 (–18) to 250 (121)

4.3.2.2 Nonmetallic Materials

The temperature class shall conform with [Table 2](#).

Table 2—Ratings for Nonmetallic Materials

Lower Limit (First Digit) °F (°C)		Upper Limit (Second Digit) °F (°C)	
A	–15 (–26.1)	A	180 (82.2)
B	0 (–17.7)	B	200 (93.3)
C	10 (–12.2)	C	220 (104.4)
D	20 (–6.6)	D	250 (121.1)
E	30 (–1.1)	E	300 (148.9)
F	40 (–4.4)	F	350 (176.7)
G	Other	G	Other
X	^a	X	^a
^a These components may have a temperature class of 40 °F to 180 °F (–4.4 °C to 82.2 °C) without performing temperature validation provided they are marked as Temperature Class “XX” in conformance with 4.3.2.2. EXAMPLE “EB” has a temperature class of 30 °F to 200 °F (–1.1 °C to 93.3 °C).			

4.3.2.3 Wellbore Elastomeric Materials

Equipment shall be designed for wellbore elastomeric materials to operate within the temperature classifications of [4.3.2.2](#).

The manufacturer shall specify the operating fluid environment (liquid, gas, or multiphase) and compatibility for the seals.