Data sheet P 530

Revision 12

1. CHEMICAL COMPOSITION

„P530“ is a special nonmagnetic, austenitic Mn-Cr-N-steel with a Nickel-content of ≤ 2%.

C	Mn	Cr	Mo	N	Ni
max. 0,05	18,50-20,00	13,00-14,00	0,40-0,60	0,25-0,40	max. 2,00

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD less than 4“	120 ksi	830 N/mm²
	OD 4“ to 9 1/4“	110 ksi	760 N/mm²
	OD 9 1/2“ and larger	100 ksi	690 N/mm²
Tensile Strength	OD less than 4“	130 ksi	900 N/mm²
	OD 4“ and larger	120 ksi	830 N/mm²
Elongation (min.):		25%	25%
Reduction of area (min.):		50%	50%
Impact energy (min.):		90 ft.lb	122 J
Hardness Brinell: (min.):		260-350 HB	260-350 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

6. GALLING RESISTANCE

„P530“ is due to the chemical composition and the special coldworking process less susceptible to galling than Cr-Ni steels.

Non-Magnetic material optimized for MWD-collars and stabilizers (higher strength and endurance) is available on special request.
P530-Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June., 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 530 HS

Revision 11

1. CHEMICAL COMPOSITION

„P530 HS“ is a special nonmagnetic, austenitic Mn-Cr-N-steel with a Nickel-content of ≤ 2%.

C	Mn	Cr	Mo	N	Ni
max. 0,05	18,50-20,00	13,00-14,00	0,40-0,60	0,25-0,40	max. 2,00

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.):	OD up to 9 1/4“	120 ksi	830 N/mm²
0,2%-offset method	OD 9 1/2“ and larger	110 ksi	760 N/mm²
Tensile Strength (min.):		130 ksi	900 N/mm²
Elongation (min.):		25%	25%
Reduction of area (min.):		50%	50%
Impact energy (min.):		90 ft.lb	122 J
Hardness Brinell:		285-365 HB	285-365 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

6. GALLING RESISTANCE

„P530 HS“ is due to the chemical composition and the special coldworking process less susceptible to galling than Cr-Ni steels.

P530 HS Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June. 2013

Data sheet P 540

Revision 0 Preliminary

1. CHEMICAL COMPOSITION

„P540“ is a special nonmagnetic, austenitic Mn-Cr-N-steel with a nitrogen content of ≤2%.

C	Mn	Cr	Mo	N	Ni
max. 0,05	19,0-21,0	17,0-19,5	0,30-0,80	min. 0,50	0,8-2,0

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to 9 1/4“	120 ksi	830 N/mm²
	OD 9 1/2“ and larger	110 ksi	760 N/mm²
Tensile Strength (min.):		130 ksi	900 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		90 ft.lb	122 J
Endurance Strength / N=10⁵ (min.):		± 65 ksi	± 455 N/mm²
Hardness Brinell:		285-400 HB	285-400 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium- and nitrogen content a high resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P540 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: Sept., 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 550

Revision 8

1. CHEMICAL COMPOSITION

„P550“ is a special nonmagnetic, austenitic Mn-Cr-steel with a high nitrogen content.

C	Mn	Cr	Mo	N	Ni
max. 0,06	20,50-21,60	18,30-20,00	min. 0,50	min. 0,60	min. 1,40

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to $9^1/_4$“	140 ksi	965 N/mm²
	OD $9^1/_2$“ and larger	130 ksi	900 N/mm²
Tensile Strength (min.):		150 ksi	1035 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		60 ft.lb	82 J
Endurance Strength / N=10^5 (min.):		± 80 ksi	± 550 N/mm²
Hardness Brinell:		350-430 HB	350-430 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium- and nitrogen content a high resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P550 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June, 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 580

Revision 2

1. CHEMICAL COMPOSITION

„P580“ is a special nonmagnetic, austenitic Mn-Cr-N-steel with a high pitting corrosion resistance, specifically developed for oilfield applications.

C	Mn	Cr	Ni	Mo	N
max. 0,06	22,00-24,50	20,50-22,00	max. 2,50	max. 1,50	min. 0,75

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to $9^1/_4$“	140 ksi	965 N/mm²
	OD $9^1/_2$“ and larger	130 ksi	900 N/mm²
Tensile Strength (min.):		150 ksi	1035 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		60 ft.lb	82 J
Endurance Strength / N=10^7 (min.):		60 ksi	414 N/mm²
Hardness Brinell:		350-450 HB	350-450 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to the very high chromium- and nitrogen contents an excellent resistance to pitting corrosion is given. A PRE-value (PRE=Cr+3,3.Mo+16.N) of min. 37 is guaranteed.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P580 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June, 2013

Data sheet P 650

Revision 3

1. CHEMICAL COMPOSITION

„P650“ is a special nonmagnetic, austenitic Mn-Cr-Mo-N-steel with a high pitting corrosion resistance, specifically developed for oilfield applications.

C	Mn	Cr	Mo	Ni	N
max. 0,06	19,50-20,50	18,00-19,00	1,70-2,00	3,00-4,50	0,55-0,65

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to 9 1/4“	140 ksi	965 N/mm²
	OD 9 1/2“ and larger	130 ksi	900 N/mm²
Tensile Strength (min.):		150 ksi	1035 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		60 ft.lb	82 J
Endurance Strength / N=10⁷ (min.):		60 ksi	414 N/mm²
Hardness Brinell:		330-430 HB	330-430 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium-, molybdenum- and nitrogen contents a high resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P650 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June, 2013

Data sheet P 650 HS

Revision 2

1. CHEMICAL COMPOSITION

„P650 HS“ is a special nonmagnetic, austenitic Mn-Cr-Mo-N-steel with a high pitting corrosion resistance and a high mechanical strength, specifically developed for oilfield applications.

C	Mn	Cr	Mo	Ni	N
max. 0,06	19,50-20,50	18,00-19,00	1,70-2,00	3,00-4,50	0,55-0,65

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to $9^1/_4$“	180 ksi	1242 N/mm²
	OD $9^1/_2$“ and larger	170 ksi	1173 N/mm²
Tensile Strength (min.):		185 ksi	1277 N/mm²
Elongation (min.):		12%	12%
Reduction of area (min.):		50%	50%
Impact energy (min.):		80 ft.lb	110 J
Endurance Strength / N=10^5 (min.):		80 ksi	550 N/mm²
Hardness Brinell:		330-450 HB	330-450 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium-, molybdenum- and nitrogen contents a high resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P650 HS Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June, 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 670

Revision 1

1. CHEMICAL COMPOSITION

„P670“ is a special nonmagnetic, austenitic Cr-Ni-Mn -steel with a high nitrogen content

C	Mn	Cr	Ni	Mo	N
max. 0,06	19,5-22,0	19,5-22,0	8,50-10,00	min 2,20	min. 0,60

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.):	OD up to $9^1/_4$“	160 ksi	1103 N/mm²
0,2%-offset method	OD $9^1/_2$“ and larger	150 ksi	1034 N/mm²
Tensile Strength (min.):		170 ksi	1172 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		80 ft.lb	108 J
Endurance Strength / N=10^5 (min.):		± 80 ksi	± 550 N/mm²
Hardness Brinell:		350-450 HB	350-450 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium-, molybdenum- and nitrogen content a excellent resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P670 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released:
Date: June, 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 750

Revision 4

1. CHEMICAL COMPOSITION

„P750“ is a high pitting corrosion resistant nonmagnetic, austenitic Cr-Ni-N-steel, specifically developed for oilfield applications.

C	Mn	Cr	Ni	Mo	N
max. 0,03	1,50-3,00	26,50-29,50	28,00-31,50	2,00-4,00	min. 0,20

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to $9^1/_4$“	140 ksi	965 N/mm²
	OD $9^1/_2$“ and larger	130 ksi	900 N/mm²
Tensile Strength (min.):		150 ksi	1035 N/mm²
Elongation (min.):		17%	17%
Reduction of area (min.):		50%	50%
Impact energy (min.):		100 ft.lb	135 J
Endurance Strength / N=10^5 (min.):		± 80 ksi	± 550 N/mm²
Hardness Brinell:		300-400 HB	300-400 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium-, nickel- and nitrogen contents a excellent resistance to pitting corrosion comparable to nickelbase alloys is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P750 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: Oct., 2015

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 750 HS

Revision 1

1. CHEMICAL COMPOSITION

„P750 HS“ is a high pitting corrosion resistant nonmagnetic, austenitic Cr-Ni-N-steel, specifically developed for oilfield applications.

C	Mn	Cr	Ni	Mo	N
max. 0,03	1,50-3,00	26,50-29,50	28,00-31,50	2,00-4,00	min. 0,20

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD max. 6“	**175 ksi**	**1208 N/mm²**
Tensile Strength (min.):		**180 ksi**	**1242 N/mm²**
Elongation (min.):		**10%**	**10%**
Reduction of area (min.):		**50%**	**50%**
Impact energy (min.):		**80 ft.lb**	**110 J**
Endurance Strength / N=10^5 (min.):		**± 80 ksi**	**± 550 N/mm²**
Hardness Brinell:		**300-420 HB**	**300-420 HB**

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to a high chromium-, nickel- and nitrogen contents an excellent resistance to pitting corrosion comparable to nickelbase alloys is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P750 HS Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: June, 2013

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet N 850 Hastelloy® C-22HS®

Revision 1

1. CHEMICAL COMPOSITION

„N850“ is a special nonmagnetic, nickel chromium molybdenum alloy.

C	Cr	Mo	Fe	Co	Ni
max. 0,01	20,00-22,00	15,00-18,00	max. 2,0	max. 1,0	remainder

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.): 0,2%-offset method	OD up to 10"	150 ksi	1035 N/mm²
Tensile Strength (min.):		160 ksi	1104 N/mm²
Elongation (min.):		15%	15%
Reduction of area (min.):		50%	50%
Impact energy (min.):		100 ft.lb	135 J
Endurance Strength / N=10^5 (min.):		± 90 ksi	± 620 N/mm²
Hardness Brinell:		300-430 HB	300-430 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,005.

4. CORROSION RESISTANCE

Superior corrosion properties compared to other Ni-based alloys are given.
The material specified conforms to ANSI/NACE MR0175 / ISO 15156.
This alloy can be used in environments containing 1000 psia (7000 kPa) H2S at a chloride concentration of 180000 mg/L and any in situ pH up to 550°F (288°C). It can be used also in enviroments containing 500 psia (3500 kPa) H2S at a chloride concentration of 180000 mg/L, at any situ pH and in the presence of elemental sulfur up to 400°F (204°C).

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test).

- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

N850 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: Oct., 2015

SCHOELLER BLECKMANN OILFIELD TECHNOLOGY

Data sheet P 690

Revision 0 Preliminary

1. CHEMICAL COMPOSITION

„P690“ is a high pitting corrosion resistant nonmagnetic, austenitic Cr-Ni-Mo-N-steel, specifically developed for oilfield applications.

C	Mn	Cr	Ni	Mo	N
max. 0,05	3,00-8,00	22,00-28,00	14,00-18,00	3,00-5,00	min. 0,40

2. MECHANICAL PROPERTIES

Following mechanical properties (tested at room temperature) are achieved by a special cold-working process over the full length of the collar:

Yield Strength (min.):	OD up to $9^1/_4$“	150 ksi	1035 N/mm²
0,2%-offset method	OD $9^1/_2$“ and larger	140 ksi	965 N/mm²
Tensile Strength (min.):		160 ksi	1104 N/mm²
Elongation (min.):		20%	20%
Reduction of area (min.):		50%	50%
Impact energy (min.):		120 ft.lb	162 J
Endurance Strength / N=10^5 (min.):		± 90 ksi	± 550 N/mm²
Hardness Brinell:		350-450 HB	350-450 HB

3. MAGNETIC PROPERTIES

Relative permeability: ≤ 1,001.

4. CORROSION RESISTANCE

- **Transgranular SCC:** Prevented by special surface treatments (Hammer peening, roller burnishing, shot peening).
- **Intergranular SCC:** The occurrence of material sensitization is prevented by quenching after warmforging. Each collar is tested according to ASTM A 262, Pract.A and E, last edition.
- **Pitting Corrosion:** Due to the high chromium-, nickel- molybdenum and nitrogen contents and the unique forging process an excellent resistance to pitting corrosion is given.

5. NON-DESTRUCTIVE TESTING

- **Magnetic inspection:** Drill collars are 100% tested by a proprietary probe-testing process using a Förster Magnetomat 1.782. (“Hot Spot“-test). Magnetic permeability of each collar is certified with the printout of probe-testing.
- **Ultrasonic inspection:** Each collar is ultrasonically inspected over 100% of the volume according to ASTM E 114, last edition as a minimum level.

P690 Non-Magnetic Drill Collars meet all requirements of API Spec. 7.1, last edition.
All tests are carried out according to ASTM-Standards, last editions.
Prepared / released: B. Holper
Date: Nov., 2018