

Přídavné svařovací materiály dle SFA/AWS

ESAB VAMBERK,s.r.o., člen koncernu



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SECTION II
MATERIALS

2017

ASME Boiler and
Pressure Vessel Code
An International Code

Part C
Specifications for Welding Rods,
Electrodes, and Filler Metals

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

Part: C

Subpart/Table:

Paragraph	Type	Subject - Description
SFA-5.20/SFA-5.20M	Revision	Adoption of AWS A5.20/A5.20M:2005 (R2015) - The 2015 Reaffirmation of AWS A5.20/A5.20M:2005, "Specification for Carbon Steel Electrodes for Flux Cored Arc Welding", was adopted as SFA-5.20/SFA-5.20M in Section II, Part C.
SFA-5.28/SFA-5.28M	Revision	Adoption of AWS A5.28/A5.28M:2005 (R2015) - The 2015 Reaffirmation of AWS A5.28/A5.28M:2005, "Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding" was adopted as SFA-5.28/SFA-5.28M in Section II Part C.
SFA-5.36/SFA-5.36M	Revision	Adoption of AWS A5.36/A5.36M:2016 as SFA-5.36/SFA-5.36M - Adopted AWS A5.36/A5.36M:2016 "Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding" as SFA-5.36/SFA-5.36M. Significant changes to the previous (2012) edition include the addition of new filler designations "K12" and "K13" as well as a change in Mn% for weld metal designation "K11" from "1.00 - 2.00" to "1.00 - 2.50".

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

ESAB OK 48.00

SFA/AWS A 5.1: E 7018
EN ISO 2560-A: E 42 4 B 42 H 5

Použití:

Nejrozšířenější OK bazická elektroda pro svařování nelegovaných a nízkolegovaných ocelí především označení P235/S235 až P420/S420 aj. Použitelná pro všechny polohy svařování s výjimkou polohy shora dole. Obal se sníženou navlhavostí poskytuje houževnatý svařový kov odolný proti praskavosti s nízkým obsahem vodíku.

Klasifikace/certifikace:

CE	EN 13479	GL	3YH5
ABS	3YH5	LR	3YH5
BV	3YH5	RS	3YH5
DB	10.039.12	VdTÖV	00690
DNV	3YH5	PRS	3YH5

Typické chemické složení čistého svařového kovu:

C	Si	Mn
0,06	0,50	1,20

Typické mechanické hodnoty čistého svařového kovu:

Podmínky	Stav	R _m MPa	R _{0,2} MPa	A ₅ %	KV (J/°C)	
					-20	-40
ISO	TZ 0	540	445	29	140	70

TZ 0 - stav po svařování

Výkonové parametry:

Průměr (mm)	Délka (mm)	Proud (A)	Napětí (V)	Výtěžnost (%)	Doba hoření (s)	Podíl sv. kovu (%)	(ks/kg sv. kovu)	Výkon navář. (kg/h)
1,6	300	30 - 55	22	127	50	0,59	192	0,38
2,0	300	50 - 80	24	123	50	0,63	119	0,60
2,5	350	80 - 110	23	130	56	0,65	62,5	1,00
3,2	450	90 - 140	23	119	76	0,64	32,3	1,50
4,0	450	125 - 210	26	123	86	0,67	20,5	2,10
5,0	450	200 - 260	23	121	102	0,69	13,5	2,60
6,0	450	220 - 340	23	117	102	0,72	9,6	3,70

Obal: bazický

Teplota přesušení: 350°C/2h

Svařovací proud:

Obsah difúzního vodíku: < 5ml/100g svar. kovu

Polohy svařování:

ESAB OK AristoRod 12.50

SFA/AWS A 5.18: ER 70S-6
EN ISO 14341A: G 3SH

Použití:

Lesklý (nepomáděný) svařovací drát určený pro svařování většiny běžných nelegovaných konstrukčních ocelí s pevností v tahu do 530 MPa, např. pro výrobu ocelových konstrukcí, tlakových nádob, transportních zařízení apod. Je vhodný i pro svařování jemnozrných ocelí s mezí kluzu do 420 MPa. Výborné podávací vlastnosti umožňují použití vysokoproduktivní metody SAT™.

Vhodnost pro svařování, např.:
P 235/S 235 až P 420/S 420 a jiné

Klasifikace/certifikace:

CE	EN 13479
ABS	3YSA
BV	SA3YM
DB	42.039.29
DNV	III YMS
GL	3YS
LR	3YS
TÖV	10052

další: CWB, RS, PRS, NAKS RINA

Ochranný plyn (EN ISO 14175):

C1, M20, M21

Klasifikace svařového kovu:

EN ISO 14341-A: G 38 3 C1 3SH
EN ISO 14341-A: G 42 4 M21 3SH

Svařovací proud:

Typické chemické složení drátu (%):

C	Si	Mn
0,10	0,90	1,50

Polohy svařování:

Jiné údaje:

W.Nr. 1.5125

Typické mechanické hodnoty čistého svařového kovu:

Podmínky	Stav	Plyn	R _m MPa	R _{0,2} (R _{p0,2}) MPa	A ₅ %	KV (J/°C)				
						+20	-20	-30	-29	-40
EN	TZ 0	M21	580	470	26	130	90	70		60
EN	TZ 1	M21	495	370	28	120	90			
EN	TZ 0	C1	540	440	25	110	70			
AWS	TZ 0	C1	>490	(>400)	>22					>27

TZ 0 - stav po svařování, TZ 1 - stav po žhání 620°C/15 h.

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

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- Part D — Properties (Metric)

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

- **SPECIFIKACE: SVAŘOVACÍ DRÁTY, ELEKTRODY A PŘÍDAVNÉ MATERIÁLY**
- **PŘÍSTUP: KATALOGY VÝROBCŮ**
- **PŘÍSTUP: DLE NOREM EN, ISO,**
- **PŘÍSTUP: KVALIFIKACE EN ISO 9606**
- **MNOHO DALŠÍCH...**

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

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Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

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„PRŮVODCE“

- ROZMĚRY
- BALENÍ
- FYZIKÁLNÍ VLASTNOSTI
- DALŠÍ

5.36 ZAHHRNUJE PŘEDCHOZÍ :

- 5.18
- 5.20
- 5.28
- 5.29
- REKVALIFIKACE

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

Product Type	Carbon Steel	Low-Alloy Steel	Stainless Steel	Nickel and Ni-Alloy	Surfacing	Cast Iron	Aluminum and Al-Alloy	Copper and Cu-Alloy	Magnesium and Mg-Alloy	Titanium and Ti-Alloy	Zirconium and Zr-Alloy	Welding and Braze Filler Metals			
Covered Solid and Metal Cored (Composite) Electrodes for SMAW	(A5.1) 1, 2, 3, 4, 5 ^d	(A5.5) 1, 2, 3, 4, 5 ^d	(A5.4) 1	(A5.11) 1, 2, 4, 6	(A5.13) 1	(A5.21) 1	(A5.15) 1	(A5.3) 1	(A5.6) 1, 4	—	—	—			
Bare Solid and Metal Cored (Composite) Rods and Electrodes for GTAW, PAW, GMAW, EGW	(A5.18, A5.36) 1, 2, 4	A5.26 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.28, A5.36) 1, 2, 4	(A5.9) 1	(A5.14) 1	(A5.13) 1	(A5.21) 1	(A5.15) 1	(A5.10) 1, 4 ^e , 9 ^e	(A5.7) 1	(A5.19) 1	(A5.16) 1	(A5.24) 1	—
Bare Solid and Metal Cored (Composite) Electrodes for SAW	(A5.17) 1	(A5.23) 1	(A5.9) 1	(A5.14) 1	—	—	—	—	—	—	—	—	—	—	—
Flux Cored Electrodes for FCAW and EGW	(A5.20, A5.36) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.26) 1, 2, 3, 4	(A5.29, A5.36) 1, 2, 3, 4	(A5.22) 1	(A5.34) 1	—	—	(A5.15) 1	—	—	—	—	—	—
Solid or Metal Cored Electrode—Flux Combinations for SAW and ESW	(A5.17) 1, 2, 3, 4	(A5.25) 1, 2, 3, 4	(A5.23) 1, 2, 3, 4	(A5.25) 1, 2, 3, 4	—	—	—	—	(A5.15) 1	—	—	—	—	—	—
Solid and Composite Rods for OFW	(A5.2) 1	(A5.2) 1	—	—	(A5.13) 1	(A5.21) 1	(A5.15) 1	(A5.10) 1, 9	(A5.7) 1	(A5.19) 1	—	—	—	—	—

- 1—Chemical analysis
- 2—Tensile
- 3—Impact
- 4—Soundness (x-ray)
- 5—Moisture test
- 6—Bend (face, side, or both)
- 7—Spattering characteristics
- 8—Sieve analysis
- 9—Bead-on-plate weld test
- Low-hydrogen electrodes only
- Test 4—for electrodes
- Test 9—for rods

➤ SFA-5.18/SFA-5.18M
 ➤ GMAW/GTAW
 ➤ NELEGOVANÉ
 ➤ 1,2,4

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

FILLER METAL: GUIDELINES

- **QAS VÝROBCE**
- **DEFINICE: MNOŽSTVÍ, TAVBA, VSÁZKA, ..**
- **LOT/CLASS: ELEKTRODY: C1–C5**
- **LOT/CLASS: DRÁTY A OSTATNÍ: S1–S4**
- **LOT/CLASS: PLNĚNÉ ELEKTRODY: T1–T4**
- **LOT/CLASS: SAW: F1-F2**

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

4.1 Fully Metallic Solid Consumables

4.1.1 Lot Class S1

The quantity of fully metallic solid welding consumables not exceeding the manufacturer's standard lot, as defined in the manufacturer's quality assurance program.

4.1.2 Lot Class S2

The quantity not exceeding 45 000 kg [100 000 lb] of one *fully metallic solid* welding consumable classification, size, form and temper produced in 24 h of consecutively scheduled production (i.e., consecutive normal work shifts) from one heat as defined in 3.4 or from controlled chemical composition material as defined in 3.5.2.

4.1.3 Lot Class S3

The quantity of one *fully metallic solid* welding consumable classification and one size produced in one production schedule as defined in 3.7 from one heat as defined in 3.4.

4.1.4 Lot Class S4

The quantity not exceeding 45 000 kg [100 000 lb] of one *fully metallic solid* welding consumable classification, size, form, and temper produced under one production schedule as defined in 3.7 from one heat as defined in 3.4 or from controlled chemical composition material as defined in 3.5.2.

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

FILLER METAL: GUIDELINES, LEVEL OF TESTING:

Table 1
Testing Schedules^a

Schedule ^b	Requirements	Reference Clause
1 or F	The manufacturer's standard testing schedule	5.1
2 or G	Classification tests from product manufactured within 12 months preceding the date of the purchase order	5.2
3 or H	Chemical analysis of <i>the specific lot</i>	5.3
4 or I	Tests called for by Table 2, for <i>the specific lot</i>	5.4
5 or J	All tests prescribed for classification in the AWS, ISO, or other applicable welding consumable standard, for <i>the specific lot</i>	5.5
6 or K	All tests specified by the purchaser for <i>the specific lot</i>	5.6

^a Testing shall be conducted in accordance with the applicable filler metal classification standard, unless otherwise agreed upon by purchaser and seller.

^b Either the numeric or alphabetic designations may be used interchangeably.

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

FILLER METAL: GUIDELINES, TERMS AND CONDITIONS:

3.8 Certificate of Compliance

A statement that the product meets the requirements of the AWS, ISO, or other applicable welding consumable specification/classification.

A summary of results may be included and may be in the form of averages, ranges, or single representative values and is not necessarily from a single set of tests run at the same time, or even unique for a specific size.

3.9 Certificate of Conformance

A test report documenting that the product meets the requirements of the AWS, ISO, or other applicable welding consumable specification/classification.

The reported results shall be in the form of a single set of tests run at the same time, using representative material/product, and may be for a specific size (diameter) or for all sizes (diameters) required to be tested for classification. Actual test values for all tests required for the AWS, ISO, or other applicable welding consumable classification shall be reported and include a date showing when these actual tests were completed. The report shall not consist of averages, ranges, or single random or “representative” values. It is not usually specific to the actual material supplied.

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

FILLER METAL: GUIDELINES, TERMS AND CONDITIONS:

3.10 Certified Material Test Report (CMTR)

A test report where there is specific reference to the tests being conducted on the actual material supplied. The CMTR may contain results of some or all of the tests required for classification, or other tests as agreed upon by the purchaser and supplier. Several examples of what these may include follow.

- Chemical analysis only (per each heat or lot, for the size supplied)—Schedule 3 or H per AWS A5.01M/A5.01.

3.11 Material Test Report (MTR)

A report documenting the results of tests performed by the manufacturer to fulfill the requirements of the material specification. Results of tests performed to meet supplementary or special requirements specified by the purchaser may also be included on the MTR. An MTR shall identify the applicable material specification and shall include unique identification linking it to the actual material supplied. A Certificate of Conformance, Certificate of Compliance, or “Typical” Test report are not considered acceptable replacements for, or equivalent to, an MTR. A CMTR is a certified copy of an MTR.

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÝ MATERIÁL

- **KLASIFIKACE (CHA ,MH,ROZSAH)**
- **DÁLE: VZORKY,TYP SVARU,RTG,...**
- **MH: (5 X KCV + 1 X TAH), ZK.OHYBEM**
- **RTG: VYHODNOCOVÁNÍ**
- **POLOHY**
- **SCHEMA ZAŘAZENÍ**
- **VAZBA NA ZM, APLIKACE**

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÉ MATERIÁLY : ELEKTRODY PRO RUČNÍ OBLOUKOVÉ SVAŘOVÁNÍ (ROS, MMA, SMAW)

- NELEGOVANÉ.....SFA-5.1/SFA-5.1M
- NÍZKOLEGOVANÉ.....SFA-5.5/SFA-5.5M
- NEREZAVĚJÍCÍ.....SFA-5.4/SFA-5.4M
- NAVAŘOVÁNÍ.....SFA-5.13
- BÁZE Al.....SFA-5.3/SFA-5.3M
- BÁZE Cu.....SFA-5.6/SFA-5.6M
- Báze Ni.....SFA-5.11/SFA-5.11M

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÉ MATERIÁLY: SVAŘOVACÍ DRÁTY GMAW/GTAW)

- **NELEGOVANÉ.....SFA-5.18/SFA-5.18M**
- **NÍZKOLEGOVANÉ.....SFA-5.28/SFA-5.28M**
- **NEREZAVĚJÍCÍ.....SFA-5.9/SFA-5.9M**
- **NAVAŘOVÁNÍ (VČ.Co).....SFA-5.21**
- **KOVY+SLIT.Al (5.10),Cu (5.7),Ni (5.14),Ti (5.16),Zr (5.24)**

- **MIG/MAG/TIG/FCAW:OCHR.PL.....FA-5.32/SFA-5.32M**

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÉ MATERIÁLY: SVAŘOVÁNÍ POD TAVIDLEM (SAW)

- **NELEGOVANÉ (vč.FCAW).....SFA-5.17/SFA-5.17M**
- **NÍZKOLEGOVANÉ.....SFA-5.23 /SFA-5.23M**
- **NEREZAVĚJÍCÍ.....SFA-5.9/SFA-5.9M**
- **BÁZE Ni (PÁSKY).....SFA-5.14/SFA-5.14M**

- **ELEKTROSTRUSKOVÉ (N+NÍZK.L.).....FA-5.25/SFA-5.25M**

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍD.MATERIÁLY: SVAŘ.PLNĚNOU ELEKTR.(FCW,FCAW)

- NELEGOVANÉ (KOVOVÁ).....SFA-5.18/SFA-5.18M
- NELEGOVANÉ (BAZICKÁ, VL.OCH.)..SFA-5.20/SFA-5.20M
- NÍZKOLEGOVANÉ (KOVOVÁ).....SFA-5.28/SFA-5.28M
- NÍZKOLEGOVANÉ (BAZ,RUTIL,VO)...SFA-5.29/SFA-5.29M
- NEREZAVĚJÍCÍ.....SFA-5.22
- FCW/FCAW.....SFA-5.36/SFA-5.36M
- BÁZE Ni.....SFA-5.34/SFA-5.34M
- ELEKTROPLYNOVÉ (N+NÍZKOL.).....SFA-5.26/SFA-5.26M

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÉ MATERIÁLY: DOSUD NEUVEDENO

- DRÁTY SV. PLAMENEM (N+NÍZK.LEG)..SFA-5.2/SFA-5.2M
- PÁJENÍ OBECNĚ (S+BEZ TAVIDLA).....SFA-5.8/SFA-5.8M
- TAVIDLA PRO PÁJENÍ.....SFA-5.31

- LITINA (PLAMEN,MMA,FCAW,GMAW).....SFA-5.15
- W-ELEKT.(TIG,PLAS.,ŘEZ.,NÁST.).....SFA-5.12/SFA-5.12M
- DODATEK PŘ.(CHA,ROZMĚRY,...).....SFA-5.30/SFA-5.30M

Part C, Specifications for Welding Rods, Electrodes, and Filler Metals.

PŘÍDAVNÉ MATERIÁLY : VYBRANÉ SKUPINY

- **MMA: NELEGOVANÉ**
- **MMA: NÍZKOLEGOVANÉ**
- **MMA: NEREZY**
- **GMAW: NELEGOVANÉ**
- **GMAW: NEREZY**
- **FCAW: NELEGOVANÉ**
- **SAW: NELEGOVANÉ**

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

ASME BPVC.II.C-2015

SFA-5.18/SFA-5.18M

TABLE 1
CHEMICAL COMPOSITION REQUIREMENTS FOR SOLID ELECTRODES AND RODS

AWS Classification ^b		UNS ^c Number	Weight Percent ^a												
A5.18	A5.18M		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu ^d	Ti	Zr	Al
ER70S-2	ER48S-2	K10726	0.07	0.90 to 1.40	0.40 to 0.70	0.025	0.035	0.15	0.15	0.15	0.03	0.50	0.05 to 0.15	0.02 to 0.12	0.05 to 0.15
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ER70S-3	ER48S-3	K11022	0.06 to 0.15	0.90 to 1.40	0.45 to 0.75	0.025	0.035	0.15	0.15	0.15	0.03	0.50	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ER70S-4	ER48S-4	K11132	0.06 to 0.15	1.00 to 1.50	0.65 to 0.85	0.025	0.035	0.15	0.15	0.15	0.03	0.50	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ER70S-6	ER48S-6	K11140	0.06 to 0.15	1.40 to 1.85	0.80 to 1.15	0.025	0.035	0.15	0.15	0.15	0.03	0.50	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ER70S-7	ER48S-7	K11125	0.07 to 0.15	1.50 to 2.00 ^e	0.50 to 0.80	0.025	0.035	0.15	0.15	0.15	0.03	0.50	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
ER70S-G	ER48S-G	—	Not Specified ^f												

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

TABLE 3
TENSION TEST REQUIREMENTS (AS WELDED)

AWS Classification ^a		Shielding Gas	Tensile Strength (minimum)		Yield Strength ^b (minimum)		Elongation ^b Percent (minimum)						
A5.18	A5.18M		psi	MPa	psi	MPa							
ER70S-2	ER48S-2	CO ₂ ^c	70 000	480	58 000	400	22						
ER70S-3	ER48S-3												
ER70S-4	ER48S-4												
ER70S-6	ER48S-6												
ER70S-7	ER48S-7												
ER70S-G	ER48S-G							d	70 000	480	58 000	400	22
E70C-3X	E48C-3X							75-80% Ar/balance CO ₂ or CO ₂	70 000	480	58 000	400	22
E70C-6X	E48C-6X												
E70C-G(X)	E48C-G(X)	d	70 000	480	58 000	400	22						
E70C-GS(X)	E48C-GS(X)	d	70 000	480	Not Specified		Not Specified						

NOTES:

- The final X shown in the classification represents a "C" or "M" which corresponds to the shielding gas with which the electrode is classified. The use of "C" designates 100% CO₂ shielding (AWS A5.32 Class SG-C); "M" designates 75-80% Ar/balance CO₂ (AWS A5.32 Class, SG-AC-Y, where Y is 20 of 25). For E70C-G [E48C-G] and E70C-GS [E48C-GS], the final "C" or "M" may be omitted.
- Yield strength at 0.2% offset and elongation in 2 in. [50 mm] gage length (or 1.4 in. [36 mm] gage length for the 0.350 in. [9.0 mm] tensile specimen recommended in A4.2 for the optional acceptance test using gas tungsten arc).
- CO₂ = carbon dioxide shielding gas (AWS A5.32 Class SG-C). The use of CO₂ for classification purposes shall not be construed to preclude the use of Ar/CO₂ (AWS A5.32 Class SG-AC-Y) or Ar/O₂ (AWS A5.32 Class SG-AO-X) shielding gas mixtures. A filler metal tested with gas

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

TABLE 4
IMPACT TEST REQUIREMENTS (AS WELDED)

AWS Classification		Average Impact Strength ^{a,b} (Minimum)	
A5.18	A5.18M	A5.18	A5.18M
ER70S-2	ER48S-2	20 ft•lbf at -20°F	27 J at -30°C
ER70S-3	ER48S-3	20 ft•lbf at 0°F	27 J at -20°C
ER70S-4	ER48S-4	Not Required	Not Required
ER70S-6	ER48S-6	20 ft•lbf at -20°F	27 J at -30°C
ER70S-7	ER48S-7	20 ft•lbf at -20°F	27 J at -30°C
ER70S-G	ER48S-G	As agreed between supplier and purchaser	
E70C-G(X)	E48C-G(X)	As agreed between supplier and purchaser	
E70C-3X	E48C-3X	20 ft•lbf at 0°F	27 J at -20°C
E70C-6X	E48C-6X	20 ft•lbf at -20°F	27 J at -30°C
E70C-GS(X)	E48C-GS(X)	Not Required	Not Required

NOTES:

- Both the highest and lowest of the five test values obtained shall be disregarded in computing the impact strength. Two of the remaining three values shall equal or exceed 20 ft•lbf [27 J]; one of the three remaining values may be lower than 20 ft•lbf [27 J], but not lower than 15 ft•lbf [20 J]. The average of the three shall not be less than the 20 ft•lbf [27 J] specified.
- For classifications with the "N" (nuclear) designation, three additional specimens shall be tested at room temperature. Two of the three shall equal, or exceed, 75 ft•lbf [100 J], and the third shall not be lower than 70 ft•lbf [95 J]. The average of the three shall equal, or exceed, 75 ft•lbf [100 J].

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

SFA-5.18/SFA-5.18M

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TABLE 5
REQUIRED TESTS

AWS Classification		Chemical Analysis		Radiographic Test	Tension Test	Bend Test	Impact Test	Diffusible Hydrogen Test
A5.18	A5.18M	Electrode	Weld Metal					
Solid Electrodes								
ER70S-2	ER48S-2	Required	Not Required	Required	Required	Not Required	Required	c
ER70S-3	ER48S-3	Required	Not Required	Required	Required	Not Required	Required	c
ER70S-4	ER48S-4	Required	Not Required	Required	Required	Not Required	Not Required	c
ER70S-6	ER48S-6	Required	Not Required	Required	Required	Not Required	Required	c
ER70S-7	ER48S-7	Required	Not Required	Required	Required	Not Required	Required	c
ER70S-G	ER48S-G	Required	Not Required	Required	Required	Not Required	Not Required	c
Composite Electrodes								
E70C-3X	E48C-3X	Not Required	Required	Required	Required	Not Required	Required	c
E70C-6X	E48C-6X	Not Required	Required	Required	Required	Not Required	Required	c
E70C-G(X)	E48C-G(X)	Not Required	Required	Required	Required	Not Required	Not Required	c
E70C-G(X) ^a	E48C-GS(X) ^a	Not Required	Not Required	Not Required	Required ^b	Required	Not Required	c

NOTES:

- a. Intended for single pass welding.
- b. Transverse tension test. All others are all-weld-metal tension tests.
- c. Optional diffusible hydrogen test is required only when specified by the purchaser or when the manufacturer puts the diffusible hydrogen designator on the label (also see A2.2 and A8.2 in Annex A).

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

15. Diffusible Hydrogen Test

15.1 For each electrode to be designated by an optional supplemental diffusible hydrogen designator, the 0.045 in. or $\frac{1}{16}$ in. [1.2 mm or 1.6 mm] size, or the size that the manufacturer produces that is closest to one of these sizes if the specified sizes are not produced, shall be tested according to one of the methods given in AWS A4.3. Based upon the average value of test results which satisfy the requirements of Table 7, the optional supplemental diffusible hydrogen designator may be added at the end of the classification.

**TABLE 7
OPTIONAL DIFFUSIBLE HYDROGEN REQUIREMENTS**

AWS Classifications	Optional Supplemental Diffusible Hydrogen Designator ^{a,b}	Average Diffusible Hydrogen, Maximum (mL/100g Deposited Metal) ^c
All	H16	16.0
All	H8	8.0
All	H4	4.0

NOTES:

- a. See Note c to Table 5.
- b. This designator is added to the end of the complete electrode classification designation.
- c. Some classifications may not be capable of meeting the lower average diffusible hydrogen levels (H8 and H4).|

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

SFA-5.18/SFA-5.18M

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TABLE 8
STANDARD SIZES^a

		Diameter	Tolerances					
			Solid		Composite			
Spools		0.020	0.5 ^c	±0.001	+0.01,-0.03	±0.002	+0.02,-0.05	
		0.025	0.6	±0.001	+0.01,-0.03	±0.002	+0.02,-0.05	
		0.030	0.8	±0.001	+0.01,-0.04	±0.002	+0.02,-0.05	
		0.035	0.9	±0.001	+0.01,-0.04	±0.002	+0.02,-0.05	
		—	1.0	—	+0.01,-0.04	—	+0.02,-0.05	
		0.045	—	±0.001	—	±0.002	—	
		—	1.2	—	+0.01,-0.04	—	+0.02,-0.05	
		0.052	—	±0.002	—	±0.002	—	
		—	1.4	—	+0.01,-0.04	—	+0.02,-0.05	
		¹ / ₁₆	0.062	1.6	±0.002	+0.01,-0.04	±0.002	+0.02,-0.06
		⁵ / ₆₄	0.078	2.0	±0.002	+0.01,-0.04	±0.003	+0.02,-0.06
		³ / ₃₂	0.094	2.4	±0.002	+0.01,-0.04	±0.003	+0.02,-0.06
		⁷ / ₆₄	0.109	2.8	±0.002	+0.01,-0.07	±0.003	+0.02,-0.06

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

TABLE 9
PACKAGING REQUIREMENTS^a

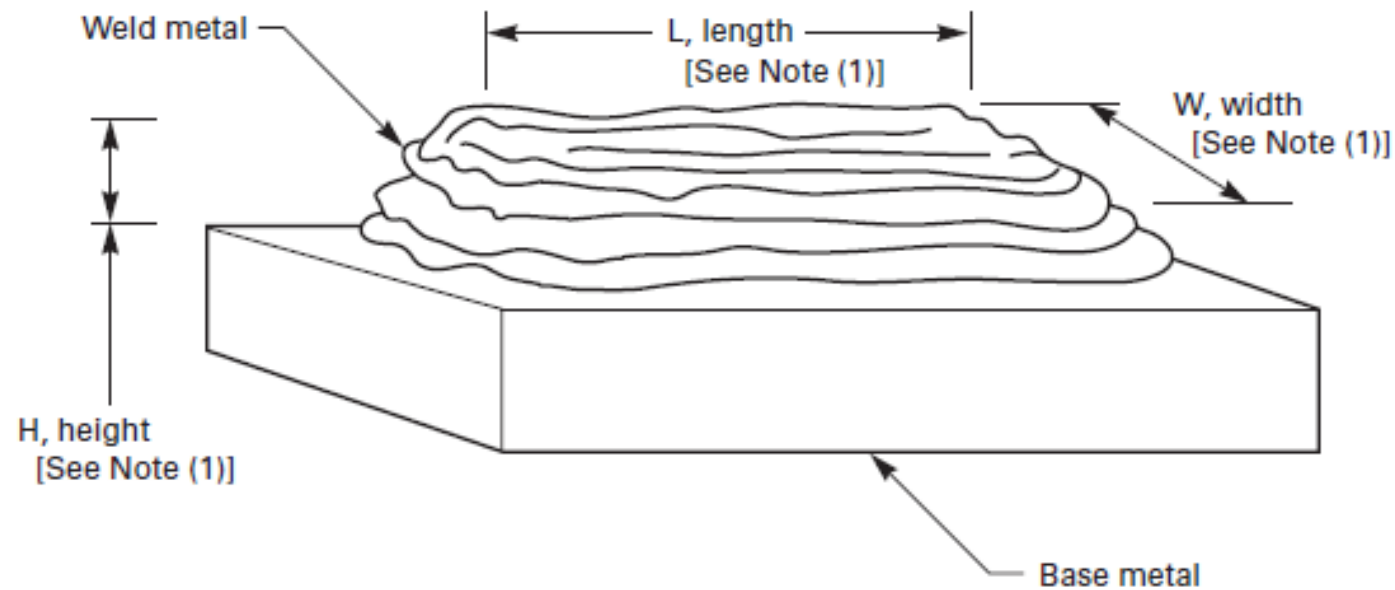
Type of Package	Package Size ^d		Net Weight of Electrode ^b			
	In.	mm	lb.	kg		
Coils without Support	As specified by purchaser ^c		As specified by purchaser ^c			
Coils with Support (see below)	6- ³ / ₄	ID	14	6		
	12	ID	25, 30, 50, 60, and 65	10, 15, 25, and 30		
Spools	4	OD	1- ¹ / ₂ and 2- ¹ / ₂	0.5 and 1.0		
	8	OD	10, 12, and 15	4.5, 5.5, and 7		
	12	OD	25, 30, 35, and 44	10, 15, and 20		
	14	OD	50 and 60	20 and 25		
	22	OD	250	100		
	24	OD	300	150		
	30	OD	600, 750, and 1000	250, 350, and 450		
Drums	15- ¹ / ₂	OD	As specified by purchaser ^c			
	20	OD	As specified by purchaser ^c			
	23	OD	300 and 600	150 and 300		
Straight Lengths	36 long	...	900 long	2, 5, 10, and 50	1, 2, 5, and 20	
Coils with Support—Standard Dimensions and Weights						
Electrode Size	Coil Net Weight ^b		Coil Dimensions			
	lb.	kg	Inside Diameter of Liner		Width of Wound Electrode	
All	14	6	In.	mm	In., max.	mm, max.
	25 and 30	10 and 15	6- ³ / ₄ ± ¹ / ₈	170 ± 3	3	75
	50, 60, and 65	20, 25, and 30	12 ± ¹ / ₈	300 +3,-10	2- ¹ / ₂ or 4- ³ / ₈	65 or 120
			12 ± ¹ / ₈	300 +3,-10	4- ³ / ₈	120

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

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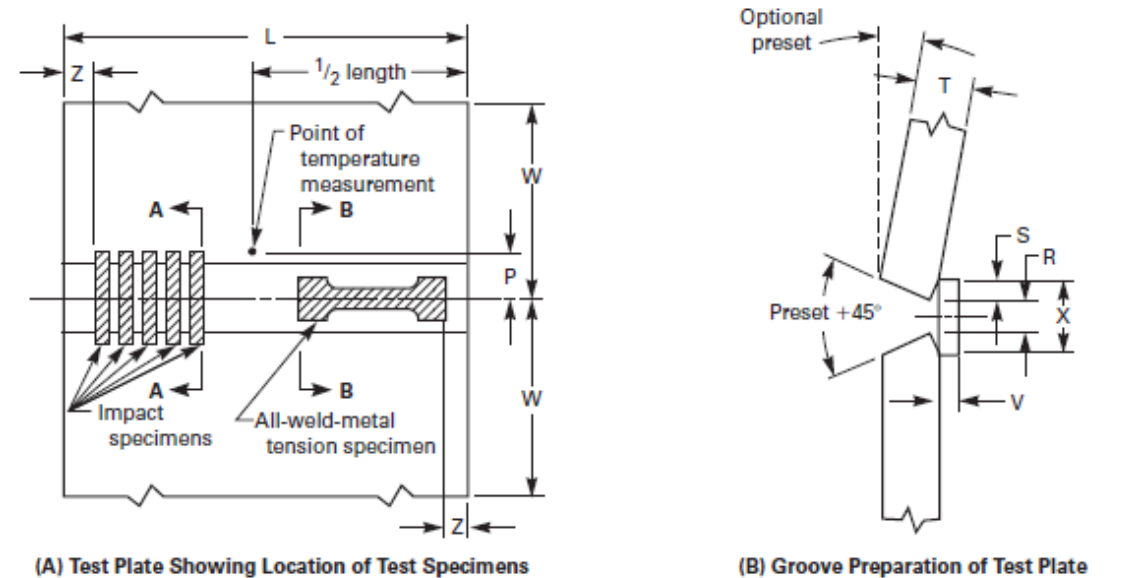
SFA-5.18/SFA-5.18M

FIG. 3 PAD FOR CHEMICAL ANALYSIS OF WELD METAL FROM COMPOSITE ELECTRODES



Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

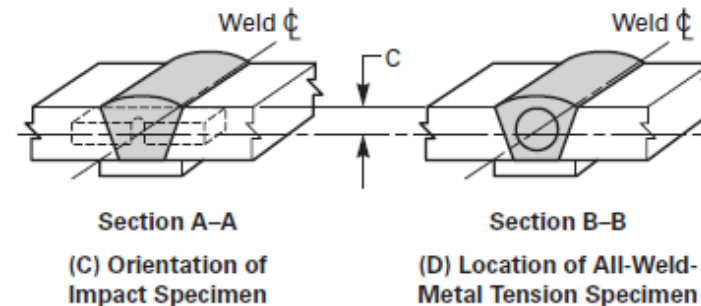
FIG. 1 GROOVE WELD TEST ASSEMBLY FOR MECHANICAL PROPERTIES AND SOUNDNESS



(A) Test Plate Showing Location of Test Specimens

(B) Groove Preparation of Test Plate

Dimensions		
	in.	mm
C Specimen center	$\frac{3}{8}$	9.5
L Length, min.	10	250
P Point of temperature measurement	1	25
R Root opening	$\frac{1}{2}$	13
S Backup strip overlap, min.	$\frac{1}{4}$	6
V Backup strip thickness, min.	$\frac{3}{8}$	9
X Backup strip width, min.	1	25
T Thickness	$\frac{3}{4}$	19
W Width, min.	5	125
Z Discard, min.	1	25



(C) Orientation of Impact Specimen

(D) Location of All-Weld-Metal Tension Specimen

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

Test Conditions for Solid Electrodes ^{1,2}				
Standard size [Note (3)]	0.045 in.	[1.2 mm]	$\frac{3}{16}$	[1.6 mm]
Shielding gas [Note (4)]	CO ₂	CO ₂	CO ₂	CO ₂
Wire feed speed	450 in./min ± 5%	[190 mm/sec] ± 5%	240 in./min ± 5%	[100 mm/sec] ± 5%
Nominal arc voltage	27 to 31 V	27 to 31 V	26 to 30 V	26 to 30 V
Resulting current, DCEP [Note (5)] (DCEP = electrode positive)	260 to 290 A	260 to 290 A	330 to 360 A	330 to 360 A
Tip-to-work distance [Note (6)]	$\frac{3}{4} \pm \frac{1}{8}$ in.	[19 ± 3 mm]	$\frac{3}{4} \pm \frac{1}{8}$ in.	[19 ± 3 mm]
Travel speed	13 ± 1 in./min	[5.5 ± 0.5 mm/sec]	13 ± 1 in./min	[5.5 ± 0.5 mm/sec]

GENERAL NOTES:

- Base metal shall be as specified in Table 6.
- The surfaces to be welded shall be clean.
- Prior to welding, the assembly may be preset as shown so that the welded joint will be sufficiently flat to facilitate test specimen removal. As an alternative, restraint or a combination of restraint and preset may be used.

NOTES:

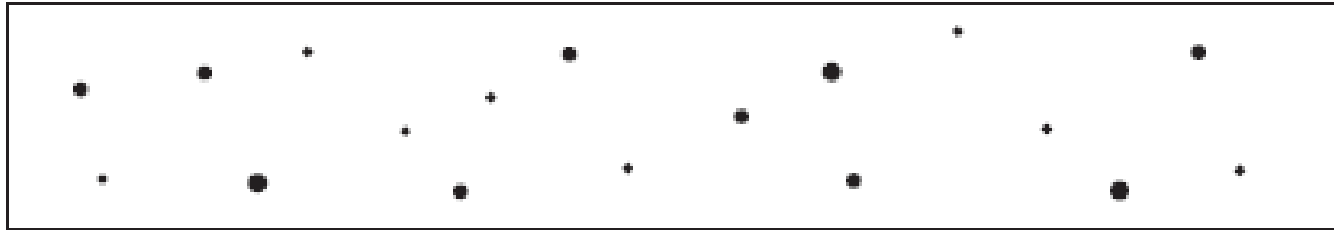
- Test conditions for composite electrodes shall be as recommended by the manufacturer.
- Preheat and interpass temperatures for both solid and composite electrodes shall be as specified in 9.3.1.
- If sizes other than 0.045 in. and $\frac{3}{16}$ in. [1.2 mm and 1.6 mm] are tested, wire feed speed (and resulting current), arc voltage, and tip-to-work distance shall be changed as needed. This joint configuration is not recommended for electrode sizes smaller than 0.035 in. [0.9 mm].
- If shielding gases or blends other than CO₂ (AWS A5.32 Class SG-C) are used, the wire feed speed (and resulting current), arc voltage, and travel speed are to be as agreed to between purchaser and supplier.
- The required combination of electrode feed rate, arc voltage, and tip-to-work distance should produce welding currents in the ranges shown. Currents substantially outside these ranges suggest errors in feed rate, tip-to-work distance, voltage settings, or in instrumentation.
- Distance from the contact tip to the work, not from the shielding gas cup to the work.

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

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SFA-5.18/SFA-5.18M

FIG. 4 RADIOGRAPHIC ACCEPTANCE STANDARDS



(a) Assorted Rounded Indications

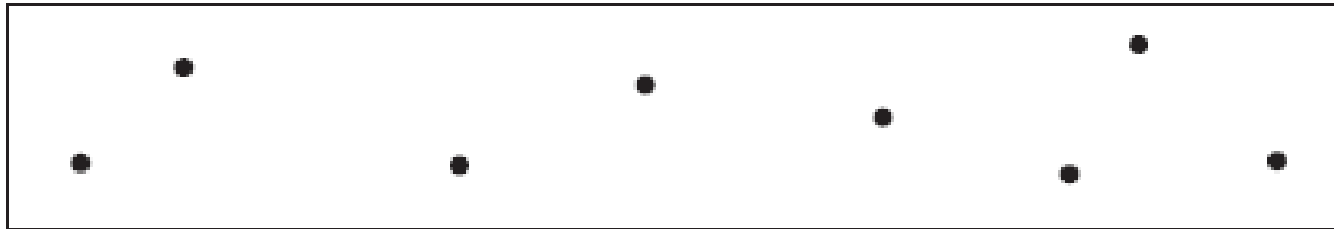
Size $1/64$ in. (0.4 mm) to $1/16$ in. (1.6 mm) in diameter or in length.

Maximum number of indications in any 6 in. (150 mm) of weld = 18, with the following restrictions:

Maximum number of large $3/64$ in. (1.2 mm) to $1/16$ in. (1.6 mm) in diameter or in length indications = 3.

Maximum number of medium $1/32$ in. (0.8 mm) to $3/64$ in. (1.2 mm) in diameter or in length indications = 5.

Maximum number of small $1/64$ in. (0.4 mm) to $1/32$ in. (0.8 mm) in diameter or in length indications = 10.

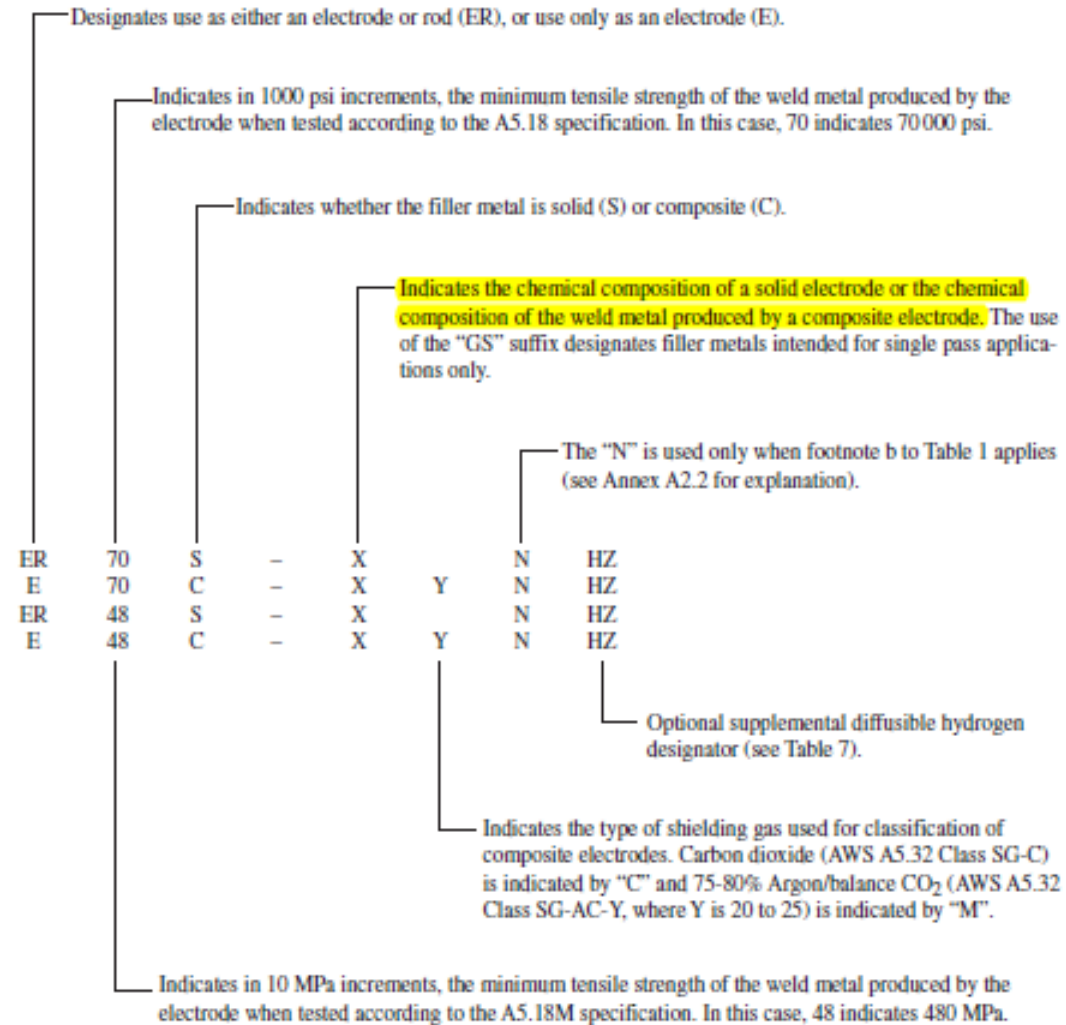


(b) Large Rounded Indications

Size $3/64$ in. (1.2 mm) to $1/16$ in. (1.6 mm) in diameter or in length.

Maximum number of indications in any 6 in. (150 mm) of weld = 3.

Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD



Part C, Svařovací drát ER70S-6 dle SFA-5.18/SFA-5.18M - PŘÍKLAD

A7.4 ER70S-6 [ER48S-6]. Electrodes and rods of the ER70S-6 [ER48S-6] classification are intended for both single- and multiple-pass welding. They are especially suited for sheet metal applications, where smooth weld beads are desired, and structural and plate steels that have moderate amounts of rust or mill scale. These electrodes permit the use of higher current ranges with either CO₂ (AWS A5.32 Class SG-C) shielding gas or with mixtures of argon and oxygen (AWS A5.32 Class SG-AO-X) or argon and carbon dioxide (AWS A5.32 Class SG-AC-Y). However, these electrodes do require a higher level of oxidation than the previously described electrodes when using either binary or ternary argon shielding gas mixtures per the AWSA5.32 specification. Typical base metal specifications are often the same as those for the ER70S-2 [ER48S-2] classification.

SHRNUTÍ/ZÁVĚR

- **PART C: 913 stránek**
- **PŘEHLED: SFA-X.YY/SFA-X.YYM**
- **OBECNÁ ČÁST**
- **ROZSAH ZKOUŠENÍ**
- **PRŮVODCE: VÝĚR DEFINIC**
- **PŘÍDAVNÝ MATERIÁL: OBECNĚ**
- **SKUPINY: SMAW, GMAW, SAW, FCAW, ..**
- **PŘÍKLAD: SVAŘOVACÍ DRÁT ER70S-6**

2017 ASME Boiler and
Pressure Vessel Code
AN INTERNATIONAL CODE

The ASME Boiler and Pressure Vessel Code (BPVC) is "An International Historic Mechanical Engineering Landmark," widely recognized as a model for codes and standards worldwide. Its development process remains open and transparent throughout, yielding "living documents" that have improved public safety and facilitated trade across global markets and jurisdictions for a century. ASME also provides BPVC users with integrated suites of related offerings:

- referenced standards
- related standards and guidelines
- conformity assessment programs
- training and development courses
- ASME Press books

