

به نام خدا



# مرکز دانلود رایگان مهندسی متالورژی و مواد

[www.Iran-mavad.com](http://www.Iran-mavad.com)



# KOBELCO

## WELDING HANDBOOK

### WELDING CONSUMABLES AND PROCESSES

 **KOBE STEEL, LTD.**  
Welding Company

[www.iran-mavad.com](http://www.iran-mavad.com)

مرجع دانشجویان و مهندسين مواد




Use the bookmark or click  
icons below for details

## Overall Index

Lists of Welding Consumables	2
For Mild Steel and 490MPa High Tensile Strength Steel	14
For Weather Proof Steel	4
For 590-780MPa High Tensile Strength Steel and Low Temperature Steel	54
For Heat-Resistant Low-Alloy Steel	84
For Stainless Steel	122
For Hardfacing	11
For Cast Iron	12
For Nickel-Base Alloy	12
Highly Efficient Welding Processes	13

• For your further information of welding consumable specifications, classifications, approvals and packages, please contact the nearest Kobelco office or sales representative.



Click the brand marked with  a red-line square for details

## Lists of Welding Consumables

Welding Process	Product Name	ASME/AWS	JIS
<b>For Mild Steel and 490MPa High Tensile Strength Steel</b>			
SMAW	<b>KOBE-6010</b>	A5.1 E6010	-
	<b>B-33</b>	A5.1 E6013	Z3211 D4313
	<b>RB-26</b>	A5.1 E6013	Z3211 D4313
	<b>TB-24</b>	A5.1 E6013	Z3211 D4303
	<b>TBI-24</b>	A5.1 E6013	Z3211 D4303
	<b>ZERODE-44</b>	A5.1 E6013	Z3211 D4303
	<b>B-10</b>	A5.1 E6019	Z3211 D4301
	<b>B-14</b>	A5.1 E6019	Z3211 D4301
	<b>B-17</b>	A5.1 E6019	Z3211 D4301
	<b>BI-14</b>	A5.1 E6019	Z3211 D4301
	<b>ZERODE-27</b>	A5.1 E6027	Z3211 D4327
	<b>LB-26</b>	A5.1 E7016	Z3211 D4316
	<b>LB-47</b>	A5.1 E7016	Z3211 D4316
	<b>LB-52</b>	A5.1 E7016	Z3212 D5016
	<b>LB-52U</b>	A5.1 E7016	Z3211 D4316
	<b>LBM-52</b>	A5.1 E7016	Z3212 D5016
	<b>LB-52A</b>	A5.1 E7016	Z3212 D5016
	<b>LB-57</b>	A5.1 E7016	Z3212 D5316
	<b>LTB-52A</b>	A5.1 E7018	Z3212 D5016
	<b>LB-52-18</b>	A5.1 E7018	Z3212 D5016
	<b>LB-52LT-18</b>	A5.1 E7018-1	-
	<b>ZERODE-43F</b>	A5.1 E7024	Z3211 D4340
	<b>ZERODE-50F</b>	A5.1 E7024	Z3212 D5000
	<b>LB-26V</b>	A5.1 E7048	Z3211 D4316
	<b>LB-52T</b>	A5.1 E7048	Z3212 D5016
	<b>LB-52V</b>	A5.1 E7048	Z3212 D5016
	<b>LB-78VS</b>	A5.1 E7048	-
	<b>KOBE-7010S</b>	A5.5 E7010-P1	-
	<b>LB-76</b>	A5.5 E7016-G	Z3212 D5316
	<b>KOBE-8010S</b>	A5.5 E8010-P1	-
	<b>LB-88VS</b>	A5.5 E8018-G	-
	<b>LB-98VS</b>	A5.5 E9018-G	-
	<b>LB-47A</b>	-	Z3211 D4316
	<b>LTB-50</b>	-	Z3212 D5003

[www.iran-mavad.com](http://www.iran-mavad.com)

Welding Process	Product Name	ASME/AWS	JIS
FCAW	<b>MX-100T</b>	A5.18 E70C-6/6M	Z3313 YFW-C50DM
	<b>MXA-100</b>	A5.18 E70C-6M	Z3313 YFW-A50DM
	<b>DW-200</b>	A5.20 E70T-1	Z3313 YFW-C50DR
	<b>MX-100</b>	A5.20 E70T-1	Z3313 YFW-C50DM
	<b>MX-100S</b>	A5.20 E70T-1	Z3313 YFW-C50DM
	<b>MX-200</b>	A5.20 E70T-1	Z3313 YFW-C50DM
	<b>MX-200H</b>	A5.20 E70T-1	Z3313 YFW-C50DM
	<b>MX-Z210</b>	A5.20 E70T-1	Z3313 YFW-C50DM
	<b>MXA-200</b>	A5.20 E70T-1M	Z3313 YFW-A50DM
	<b>DW-100</b>	A5.20 E71T-1	Z3313 YFW-C50DR
	<b>DW-100V</b>	A5.20 E71T-1	Z3313 YFW-C50DR
	<b>DW-110</b>	A5.20 E71T-1	Z3313 YFW-C50DR
	<b>DW-50</b>	A5.20 E71T-1/1M	Z3313 YFW-C50DR
	<b>FRONTIARC-711</b>	A5.20 E71T-1/1M/12/12M	Z3313 YFW-C50DR
	<b>DWA-50</b>	A5.20 E71T-1M	Z3313 YFW-A50DR
	<b>DWA-51B</b>	A5.20 E71T-5MJ	Z3313 YFW-A502B
GMAW	<b>MIX-50</b>	A5.18 ER70S-3	Z3312 YGW16
	<b>MG-51T</b>	A5.18 ER70S-6	Z3312 YGW12
	<b>MIX-50S</b>	A5.18 ER70S-G	Z3312 YGW15
	<b>MG-50</b>	A5.18 ER70S-G	Z3312 YGW11
	<b>MGS-50</b>	A5.18 ER70S-G	Z3312 YGW16
	<b>MG-50D</b>	-	-
	<b>MG-50T</b>	-	Z3312 YGW12
GTAW	<b>NO65G</b>	A5.18 ER70S-2	Z3316 YGT50
	<b>TGS-51T</b>	A5.18 ER70S-6	Z3316 YGT50
	<b>TGS-50</b>	A5.18 ER70S-G	Z3316 YGT50
SAW	<b>PFH-45/US-43</b>	A5.17 F6A4-EL8	Z3183 S422-S
	<b>MF-44/US-36</b>	A5.17 F7A0-EH14	Z3183 S501-H
	<b>MF-53/US-36</b>	A5.17 F7A0-EH14	Z3183 S501-H
	<b>G-50/US-36</b>	A5.17 F7A2-EH14	Z3183 S502-H
	<b>G-60/US-36</b>	A5.17 F7A2-EH14	Z3183 S502-H
	<b>G-80/US-36</b>	A5.17 F7A2-EH14, F6P2-EH14	-
	<b>MF-38A/US-36</b>	A5.17 F7A4-EH14	Z3183 S502-H
	<b>PFH-55E/US-36</b>	A5.17 F7A4-EH14	Z3183 S502-H




Click the brand marked with  a red-line square for details

Welding Process	Product Name	ASME / AWS	JIS
SAW	<b>PFH-60A/US-43</b>	A5.17 F7A4-EL8	Z3183 S502-H
	<b>AF-490/US-12K</b>	A5.17 F7A4-EM12K F6P6-EM12K	-
	<b>MF-300/US-36</b>	A5.17 F7A6-EH14 F7P6-EH14	Z3183 S502-H
	<b>MF-38/US-36</b>	A5.17 F7A6-EH14 F7P6-EH14	Z3183 S502-H
	<b>PFI-53ES/US-36L</b>	-	-
<b>For Weather Proof Steel</b>			
SMAW	<b>LBW-52</b>	A5.5 E7016-G	Z3214 DA5016G
	<b>LBW-52B</b>	A5.5 E7016-G	Z3214 DA5016W
	<b>LBW-588</b>	A5.5 E8016-C3	-
	<b>LBW-62G</b>	A5.5 E8018-W2	Z3214 DA5816W
FCAW	<b>DW-588</b>	A5.29 E81T1-W2	Z3320 YFA-58W
	<b>DW-50W</b>	-	Z3320 YFA-50W
GMAW	<b>MGW-50TB</b>	A5.28 ER80S-G	Z3315 YGA-50W
	<b>MGW-588</b>	A5.28 ER80S-G	Z3315 YGA-58W
GTAW	<b>TGS-588</b>	A5.28 ER80S-G	-
SAW	<b>MF-53/USW-52B</b>	A5.23 F7A0-EG-G	Z3183 S501-AW
	<b>MF-38/USW-52B</b>	A5.23 F7A2-EG-G	Z3183 S502-AW
	<b>MF-38A/USW-52B</b>	A5.23 F7A2-EG-G	Z3183 S502-AW
	<b>MF-63/USW-62B</b>	A5.23 F8A0-EG-G	Z3183 S581-AW
	<b>MF-38/USW-62B</b>	A5.23 F8A2-EG-G	Z3183 S582-AW
	<b>MF-38/USW-588</b>	A5.23 F8A4-EW-W	-
<b>For 590-780MPa High Tensile Steel and Low Temperature Steel</b>			
SMAW	<b>NB-3J</b>	A5.5 E7016-C2L	Z3241 DL5016-10AP3
	<b>NBA-52V</b>	A5.5 E7016-G	Z3212 D5016
	<b>LB-52NS</b>	A5.5 E7016-G	Z3212 D5016
	<b>NB-3N</b>	A5.5 E7016-G	Z3241 DL5016-10P3
	<b>NBA-52F</b>	A5.5 E7018-G	Z3212 D5026
	<b>LB-62L</b>	A5.5 E8016-C1	-
	<b>NB-2</b>	A5.5 E8016-C1	Z3241 DL5016-6AP2
	<b>NB-1SJ</b>	A5.5 E8016-G	Z3241 DL5016-6AP1
	<b>LB-62</b>	A5.5 E9016-G	Z3212 D5816
	<b>LB-62N</b>	A5.5 E9016-G	Z3212 D5816

Welding Process	Product Name	ASME / AWS	JIS
SMAW	<b>LB-62U</b>	A5.5 E9016-G	Z3212 D5816
	<b>LB-62UL</b>	A5.5 E9016-G	Z3212 D5816
	<b>LB-62D</b>	A5.5 E9018-G	Z3212 D5816
	<b>LB-106</b>	A5.5 E10016-G	Z3212 D7016
	<b>LB-116</b>	A5.5 E11016-G	Z3212 D8016
	<b>LB-80UL</b>	A5.5 E11016-G	Z3212 D8016
	<b>LB-88LT</b>	A5.5 E11016-G	Z3212 D8016
FCAW	<b>MX-55LF</b>	A5.20 E70T-9J	Z3313 YFL-C506R
	<b>DWA-55ESR</b>	A5.20 E71T-12MJ	-
	<b>DW-100E</b>	A5.20 E71T-9	Z3313 YFL-C502R
	<b>DW-55E</b>	A5.20 E71T-9J	Z3313 YFL-C504R
	<b>DWA-55E</b>	A5.20 E71T-9MJ	Z3313 YFL-A504R
	<b>MXA-55T</b>	A5.28 E80C-G	Z3313 YFL-A506M
	<b>DW-55L</b>	A5.29 E81T1-K2	Z3313 YFL-C506R
	<b>DW-55LSR</b>	A5.29 E81T1-K2	Z3313 YFL-C506R
	<b>DWA-55L</b>	A5.29 E81T1-K2M	Z3313 YFL-A506R
	<b>DWA-55LSR</b>	A5.29 E81T1-Ni1M	Z3313 YFL-A506R
	<b>DWA-65L</b>	A5.29 E91T1-K2MJ	-
GMAW	<b>MGS-50LT</b>	A5.18 ER70S-G	Z3325 YGL1-6A (AP)
	<b>MGS-1N</b>	A5.28 ER70S-G	Z3325 YGL2-6A (P)
	<b>MGS-3N</b>	A5.28 ER70S-G	Z3325 YGL3-10G (P)
	<b>MG-60</b>	A5.28 ER80S-G	Z3312 YGW21
	<b>MGT-1NS</b>	A5.28 ER80S-G	-
	<b>MGS-63B</b>	A5.28 ER90S-G	Z3312 YGW23
	<b>MG-70</b>	A5.28 ER100S-G	-
	<b>MGS-70</b>	A5.28 ER100S-G	-
	<b>MG-80</b>	A5.28 ER110S-G	-
	<b>MGS-80</b>	A5.28 ER110S-G	-
	<b>MGS-88A</b>	A5.28 ER120S-G	-
GTAW	<b>TGS-3N</b>	A5.28 ER70S-G	-
	<b>TGS-1N</b>	A5.28 ER70S-G	-
	<b>TGS-60A</b>	A5.28 ER80S-G	Z3316 YGT62
	<b>TGS-62</b>	A5.28 ER80S-G	Z3316 YGT60
	<b>TGS-80AM</b>	A5.28 ER110S-G	Z3316 YGT80



Click the brand marked with  a red-line square for details


Welding Process	Product Name	ASME / AWS	JIS
SAW	<b>MF-38/US-49A</b>	A5.17 F7A6-EH14 F7P6-EH14	-
	<b>PFH-55S/US-49A</b>	A5.17 F7A6-EH14 F7P6-EH14	-
	<b>PFH-55LT/US-36</b>	A5.17 F7A8-EH14	-
	<b>PFH-55AS/US-36J</b>	A5.17 F7P8-EH14	-
	<b>PFH-203/US-203E</b>	A5.23 F7P15-ENi3-Ni3	-
	<b>MF-38A/US-A4</b>	A5.23 F8A4-EA4-A4	Z3183 S584-H
	<b>MF-38/US-A4</b>	A5.23 F8A4-EA4-A4 F8P6-EA4-A4	Z3183 S584-H
	<b>MF-38A/US-49</b>	A5.23 F8A4-EG-A4	Z3183 S584-H
	<b>MF-38/US-49</b>	A5.23 F8A4-EG-A4 F8P6-EG-A4	Z3183 S584-H
	<b>PFH-55S/US-255</b>	A5.23 F9A5-EG-G F8P5-EG-G	-
	<b>MF-38/US-40</b>	A5.23 F9A6-EA3-A3 F8P6-EA3-A3	Z3183 S624-H1
	<b>MF-38/US-70</b>	A5.23 F10A6-EG-G	Z3183 S704-H1
	<b>PFH-80AS/US-80LT</b>	A5.23 F11A10-EG-G	-
	<b>PFH-80AK/US-80BN</b>	A5.23 F11A4-EG-G	Z3183 S804-H4
	<b>PFH-80AK/US-80LT</b>	A5.23 F12A10-EG-G	-

### For Heat-Resistant Low-Alloy Steel

SMAW	<b>BL-76</b>	A5.1 E7016	Z3212 D5016
	<b>BL-106</b>	A5.5 E10016-G	-
	<b>CMB-95</b>	A5.5 E7015-B2L	Z3223 DT2315
	<b>CMA-76</b>	A5.5 E7016-A1	Z3223 DT1216
	<b>CMB-83</b>	A5.5 E8013-G	-
	<b>CMB-105</b>	A5.5 E8015-B3L	Z3223 DT2415
	<b>CMB-86</b>	A5.5 E8016-B1	-
	<b>CMA-96</b>	A5.5 E8016-B2	Z3223 DT2316
	<b>CMA-96MB</b>	A5.5 E8016-B2	Z3223 DT2316
	<b>CM-5</b>	A5.5 E8016-B6	Z3223 DT2516
	<b>CM-9</b>	A5.5 E8016-B8	Z3223 DT2616
	<b>CMB-98</b>	A5.5 E8018-B2	Z3223 DT2318
	<b>CMA-106</b>	A5.5 E9016-B3	Z3223 DT2416
	<b>CMA-106N</b>	A5.5 E9016-B3	Z3223 DT2416

Welding Process	Product Name	ASME / AWS	JIS
SMAW	<b>CM-96B9</b>	A5.5 E9016-B9	-
	<b>BL-96</b>	A5.5 E9016-G	-
	<b>CM-9Cb</b>	A5.5 E9016-G	-
	<b>CMB-108</b>	A5.5 E9018-B3	Z3223 DT2418
	<b>CM-2CW</b>	-	-
	<b>CM-3H</b>	-	-
	<b>CMA-106H</b>	-	-
	<b>CMA-106HD</b>	-	-
FCAW	<b>DW-81B2</b>	A5.29 E81T1-B2/B2M	-
	<b>DWA-81B2</b>	A5.29 E81T1-B2M	-
	<b>DW-91B3</b>	A5.29 E91T1-B3/B3M	-
	<b>DWA-91B3</b>	A5.29 E91T1-B3M	-
GMAW	<b>MGS-5CM</b>	A5.28 ER80S-B6	Z3317 YG5CM-A
	<b>MGS-9CM</b>	A5.28 ER80S-B8	-
	<b>MGS-56</b>	A5.28 ER80S-G	-
	<b>MGS-1CM</b>	A5.28 ER80S-G	Z3317 YG1CM-A
	<b>MGS-M</b>	A5.28 ER80S-G	Z3317 YGM-A
	<b>MGS-9Cb</b>	A5.28 ER90S-G	-
	<b>MGS-2CM</b>	A5.28 ER90S-G	Z3317 YG2CM-A
	<b>MG-1CM</b>	A5.28 ER80S-G	Z3317 YG1CM-C
	<b>MG-CM</b>	A5.28 ER80S-G	Z3317 YGCM-C
	<b>MG-M</b>	A5.28 ER80S-G	Z3317 YGM-C
	<b>MGT-1CM</b>	A5.28 ER80S-G	Z3317 YG1CM-A
	<b>MGT-M</b>	A5.28 ER80S-G	Z3317 YGM-A
	<b>MG-2CM</b>	A5.28 ER90S-G	Z3317 YG2CM-C
	<b>MGS-63S</b>	A5.28 ER90S-G	-
	<b>MGT-2CM</b>	A5.28 ER90S-G	Z3317 YG2CM-A
	<b>MGS-2CMS</b>	A5.28 ER90S-G	Z3317 YG2CM-A
GTAW	<b>TGS-5CM</b>	A5.28 ER80S-B6	Z3316 YGT5CM
	<b>TGS-9CM</b>	A5.28 ER80S-B8	-
	<b>TGS-1CML</b>	A5.28 ER80S-G	Z3316 YGT1CML
	<b>TGS-2CML</b>	A5.28 ER80S-G	Z3316 YGT2CML
	<b>TGS-56</b>	A5.28 ER80S-G	-



Click the brand marked with  a red-line square for details

Welding Process	Product Name	ASME / AWS	JIS
GTAW	<b>TGS-1CM</b>	A5.28 ER80S-G	Z3316 YGT1CM
	<b>TGS-M</b>	A5.28 ER80S-G	Z3316 YGTM
	<b>TGS-90B9</b>	A5.28 ER90S-B9	-
	<b>TGS-2CM</b>	A5.28 ER90S-G	Z3316 YGT2CM
	<b>TGS-9Cb</b>	A5.28 ER90S-G	-
	<b>TGS-2CMH</b>	-	-
	<b>TGS-2CW</b>	-	-
	<b>TGS-3CMH</b>	-	-
	<b>TGS-CM</b>	-	-
SAW	<b>PF-200S/US-502</b>	A5.23 F7P2-EG-B6	Z3183 S502-5CM
	<b>MF-29A/US-511</b>	A5.23 F7PZ-EG-B2	Z3183 S641-1CM
	<b>PF-200/US-511N</b>	A5.23 F8P2-EG-B2	Z3183 S642-1CM
	<b>MF-29A/US-521</b>	A5.23 F8P2-EG-B3	Z3183 S571-2CM
	<b>MF-38/US-A4</b>	A5.23 F8P6-EA4-A4 F8A4-EA4-A4	-
	<b>MF-38/US-49</b>	A5.23 F8P6-EG-A4 F8A4-EG-A4	Z3183 S584-H
	<b>MF-38/US-40</b>	A5.23 F8P6-EA3-A3 F9A6-EA3-A3	Z3183 S624-H1
	<b>PF-200/US-521S</b>	A5.23 F9P2-EG-B3	Z3183 S642-2CM
	<b>MF-27/US-56B</b>	A5.23 F9P4-EG-G	Z3183 S642-MN
	<b>PF-200/US-56B</b>	A5.23 F9P4-EG-G	Z3183 S642-MN
	<b>MF-29AX/US-63S</b>	A5.23 F10P2-EG-G	Z3183 S642-MN
	<b>PF-200/US-63S</b>	A5.23 F10P2-EG-G	Z3183 S642-MN
	<b>PF-200S/US-9Cb</b>	A5.23 F10PZ-EG-G	-
	<b>PF-500/US-521H</b>	-	-
	<b>PF-500D/US-521HD</b>	-	-
	<b>PF-500/US-531H</b>	-	-
<b>For Stainless Steel</b>			
SMAW	<b>NC-16H</b>	A5.4 E16-8-2-16	Z3221 D16-8-2-16
	<b>NC-38</b>	A5.4 E308-16	Z3221 D308-16
	<b>NC-38H</b>	A5.4 E308H-16	Z3221 D308-16
	<b>NC-38LT</b>	A5.4 E308L-16	Z3221 D308L-16
	<b>NC-38L</b>	A5.4 E308L-16	Z3221 D308L-16

Welding Process	Product Name	ASME / AWS	JIS
SMAW	<b>NC-39</b>	A5.4 E309-16	Z3221 D309-16
	<b>NC-39L</b>	A5.4 E309L-16	Z3221 D309L-16
	<b>NC-39MoL</b>	A5.4 E309MoL-16	Z3221 D309MoL-16
	<b>NC-30</b>	A5.4 E310-16	Z3221 D310-16
	<b>NC-32</b>	A5.4 E312-16	Z3221 D312-16
	<b>NC-36</b>	A5.4 E316-16	Z3221 D316-16
	<b>NC-36L</b>	A5.4 E316L-16	Z3221 D316L-16
	<b>NC-36LT</b>	A5.4 E316L-16	Z3221 D316L-16
	<b>NC-317L</b>	A5.4 E317L-16	Z3221 D317L-16
	<b>NC-318</b>	A5.4 E318-16	Z3221 D318-16
	<b>NC-37</b>	A5.4 E347-16	Z3221 D347-16
	<b>NC-37L</b>	A5.4 E347-16	Z3221 D347L-16
	<b>CR-40</b>	A5.4 E410-16	Z3221 D410-16
	<b>CR-43</b>	A5.4 E430-16	Z3221 D430-16
	<b>CR-40Cb</b>	-	Z3221 D410Nb-16
	<b>CR-43Cb</b>	-	Z3221 D430Nb-16
	<b>CR-43CbS</b>	-	-
	<b>NC-316MF</b>	-	-
	<b>NC-329M</b>	-	-
FCAW	<b>DW-329A</b>	A5.22 E2209T0-1/4	-
	<b>DW-329AP</b>	A5.22 E2209T1-1/4	-
	<b>DW-308H</b>	A5.22 E308HT1-1/4	Z3323 YF308C
	<b>DW-308L</b>	A5.22 E308LT0-1/4	Z3323 YF308LC
	<b>DW-308LT</b>	A5.22 E308LT0-1/4	Z3323 YF308LC
	<b>DW-308LH</b>	A5.22 E308LT1-1/4	Z3323 YF308LC
	<b>DW-308LP</b>	A5.22 E308LT1-1/4	Z3323 YF308LC
	<b>DW-308</b>	A5.22 E308T0-1/4	Z3323 YF308C
	<b>DW-309MoL</b>	A5.22 E309LMoT0-1/4	Z3323 YF309MoLC
	<b>DW-309MoLP</b>	A5.22 E309LMoT1-1/4	Z3323 YF309MoLC
	<b>DW-309L</b>	A5.22 E309LT0-1/4	Z3323 YF309LC
	<b>DW-309LP</b>	A5.22 E309LT1-1/4	Z3323 YF309LC
	<b>DW-309</b>	A5.22 E309T0-1/4	Z3323 YF309C
	<b>DW-309LH</b>	A5.22 E309LT1-1/4	Z3323 YF309LC
	<b>DW-310</b>	A5.22 E310T0-1/4	-





Click the brand marked with  a red-line square for details

Welding Process	Product Name	ASME / AWS	JIS
FCAW	DW-312	A5.22 E312T0-1	-
	DW-316L	A5.22 E316LT0-1/4	Z3323 YF316LC
	DW-316LT	A5.22 E316LT1-1/4	Z3323 YF316LC
	DW-316LH	A5.22 E316LT1-1/4	Z3323 YF316LC
	DW-316LP	A5.22 E316LT1-1/4	Z3323 YF316LC
	DW-316	A5.22 E316T0-1/4	Z3323 YF316C
	DW-316H	A5.22 E316T1-1/4	Z3323 YF316C
	DW-317L	A5.22 E317LT0-1/4	Z3323 YF317LC
	DW-347	A5.22 E347T0-1/4	Z3323 YF347C
	DW-347H	A5.22 E347T1-1/4	Z3323 YF347C
	TGX-308L	A5.22 R308LT1-5	-
	TGX-309L	A5.22 R309LT1-5	-
	TGX-316L	A5.22 R316LT1-5	-
	TGX-347	A5.22 R347T1-5	-
	DW-410Cb	-	-
	DW-430CbS	-	-
	MXA-135N	-	-
	MXA-410NM	-	-
	MXA-430M	-	-
GMAW	MGS-308	A5.9 ER308	Z3321 Y308
	MGS-308LS	A5.9 ER308LSi	Z3321 Y308LSi
	MGS-309	A5.9 ER309	Z3321 Y309
	MGS-309LS	A5.9 ER309LSi	Z3321 Y309Si
	MGS-316LS	A5.9 ER316LSi	Z3321 Y316LSi
	MGS-347S	A5.9 ER347Si	Z3321 Y347Si
	MGS-430M	-	-
GTAW	TGS-308	A5.9 ER308	Z3321 Y308
	TGS-308L	A5.9 ER308L	Z3321 Y308L
	TGS-309	A5.9 ER309	Z3321 Y309
	TGS-309L	A5.9 ER309L	Z3321 Y309L
	TGS-309MoL	A5.9 ER309LMo	Z3321 Y309Mo
	TGS-310	A5.9 ER310	Z3321 Y310
	TGS-316	A5.9 ER316	Z3321 Y316
	TGS-316L	A5.9 ER316L	Z3321 Y316L

Welding Process	Product Name	ASME / AWS	JIS
GTAW	TGS-317L	A5.9 ER317L	Z3321 Y317L
	TGS-347	A5.9 ER347	Z3321 Y347
	TGS-410	A5.9 ER410	Z3321 Y410
	TGS-310MF	-	-
	NO4051	-	-
	TGS-329E	-	-
	TGS-410Cb	-	-
SAW	PFS-1/US-308	A5.9 ER308	Z3324 S308
	PFS-1/US-308L	A5.9 ER308L	Z3324 S308L
	PFS-1LT/US-308L	A5.9 ER308L	Z3324 S308L
	PFS-1/US-309	A5.9 ER309	Z3324 S309
	PFS-1/US-309L	A5.9 ER309L	Z3324 S309L
	PFS-1M/US-316	A5.9 ER316	Z3324 S316
	PFS-1M/US-316L	A5.9 ER316L	Z3324 S316L
	PFS-1/US-317L	A5.9 ER317L	Z3324 S317L
	PFS-1/US-347	A5.9 ER347	Z3324 S347
	PFS-4M/US-410	-	Z3324 SSG
<b>For Hardfacing</b>			
SMAW	HF-240	-	Z3251 DF2A-250-R
	HF-260	-	Z3251 DF2A-300-B
	HF-330	-	Z3251 DF2A-350-R
	HF-350	-	Z3251 DF2A-400-B
	HF-450	-	Z3251 DF2A-450-B
	HF-500	-	Z3251 DF2B-500-B
	HF-600	-	Z3251 DF2B-600-B
	HF-650	-	Z3251 DF3C-600-B
	HF-700	-	Z3251 DF3C-600-B
	HF-800K	-	Z3251 DF3C-700-B
	HF-950	-	-
	HF-11	-	Z3251 DFMA-250-B
	HF-12	-	Z3251 DF3C-500-B
	HF-13	-	Z3251 DF4A-450-B
	HF-16	-	Z3251 DFME-300-B
	HF-30	-	Z3251 DFCrA-700-B

Welding Process	Product Name	ASME / AWS	JIS
FCAW	DWH-250	-	Z3326 YF2A-C-250
	DWH-350	-	Z3326 YF2A-C-350
	DWH-450	-	Z3326 YF3B-C-450
	DWH-600	-	Z3326 YF3B-C-600
	DWH-700	-	Z3326 YF3B-C-700
	DWH-800	-	Z3326 YF3B-C-800
	DWH-11	-	Z3326 YFMA-C-250
	DWH-16	-	Z3326 YFME-C-300
	DWH-30	-	Z3326 YFCrA-C-700
	DWH-30MV	-	Z3326 YFCrA-C-800
SAW	G-50/USH-250N	-	-
	G-50/USH-350N	-	-
	G-50/USH-400N	-	-
	G-50/USH-450N	-	-
	G-50/USH-500N	-	-
	MF-30/USH-550N	-	-
	MF-30/USH-600N	-	-
<b>For Cast Iron</b>			
SMAW	CIA-1	A5.15 ENi-Ci	Z3252 DFCNi
	CIA-2	A5.15 ENiFe-Ci	Z3252 DFCNiFe
	CIA-3	A5.15 Est	Z3252 DFCFe
	CIA-5	-	-
<b>For Nickel-Base Alloy</b>			
SMAW	NIC-70A	A5.11 ENiCrFe-1	Z3224 DNiCrFe-1J-16
	NIC-703D	A5.11 ENiCrFe-3	Z3224 DNiCrFe-3-15
	NIC-70E	A5.11 ENiCrFe-9	Z3225 D9Ni-1
	NIC-70S	A5.11 ENiCrFe-9	Z3225 D9Ni-1
	NIC-1S	A5.11 ENiMo-8	Z3225 D9Ni-2
	NIC-625	-	-
FCAW	DWN-70S	-	-
	DWN-82	-	-
	DWN-625	-	-
	DWN-625M	-	-
GMAW	MGS-70NCb	A5.14 ERNiCr-3	Z3334 YNiCr-3

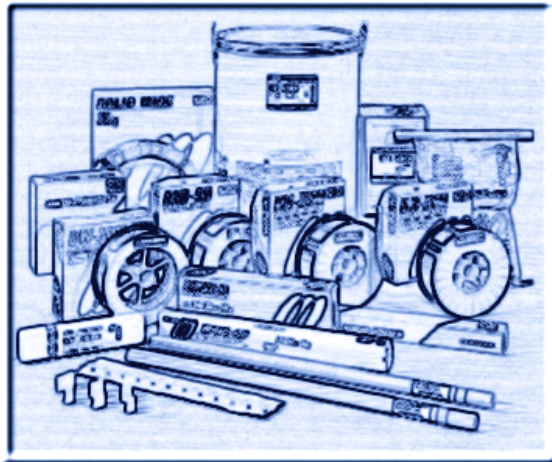
Welding Process	Product Name	ASME / AWS	JIS
GTAW	TGS-70NCb	A5.14 ERNiCr-3	Z3334 YNiCr-3
	TGS-N625	A5.14 ERNiCrMo-3	Z3334 YNiCrMo-3
	TGS-709S	A5.14 ERNiMo-8	Z3332 YGT9Ni-2
SAW	PFN-3/US-709S	A5.14 ERNiMo-8	Z3333 FS9Ni-F/YS9Ni
	PFN-4/US-709S	A5.14 ERNiMo-8	Z3333 FS9Ni-H/YS9Ni
<b>Highly Efficient Welding Processes</b>			
FCB	PFI-50/PFI-50R/US-43	-	-
	PFI-55E/PFI-50R/US-36	-	-
RF	PFH-55E/RF-1/US-36	-	-
FAB	MF-38/RR-2/US-36	-	-
	MF-38/RR-2/US-49	-	-
	PFI-52E/RR-2/US-36	-	-
EGW	DWS-43G	A5.26 EG70T-2	Z3319 YFEG-22C
	DWS-1LG	-	-
	DWS-60G	-	Z3319 YFEG-32C
H-SAW	MF-33H/US-36	A5.17 F7A6-EH14 F7P6-EH14	Z3183 S502-H
	MF-33H/US-49	A5.23 F8A6-EG-A4 F8P6-EG-A4	Z3183 S624-H1
	MF-33H/US-49A	A5.17 F7A6-EH14 F7P6-EH14	-
EAW	LB-116	A5.5 E11016-G	Z3212 D8016
	LB-80EM	-	Z3212 D8000





Use the bookmark or click ☐  
the list mark below for details

## For Mild Steel and 490MPa High Tensile Strength Steel



■ A guide for selecting covered electrodes

### Welding consumables and proper welding conditions for

- Shielded Metal Arc Welding (SMAW)
- Flux Cored Arc Welding (FCAW)
- Gas Metal Arc Welding (GMAW)
- Gas Tungsten Arc Welding (GTAW)
- Submerged Arc Welding (SAW)

## For Mild Steel and 490MPa High Tensile Strength Steel

■ A guide for selecting filler metals for API grade pipes and comparison of welding procedures <sup>(1)</sup>

API 5L pipe grade	Welding pass	With high cellulose electrodes	With low hydrogen electrodes		
		Downhill welding process	Uphill welding process	Downhill welding process	
				With only low hydrogen electrodes	With a combination of high cellulose and low hydrogen electrodes
<b>A25 A, B X42 X46 X52</b>	Root	KOBE-6010 KOBE-7010S	LB-52U	LB-78VS	KOBE-6010 KOBE-7010S
	Hot		LB-47 LB-52 LBM-52 LB-52-18		LB-78VS
	Filler and cap				
<b>X56</b>	Root	KOBE-6010	LB-52U	LB-78VS	KOBE-6010 KOBE-7010S
	Hot	KOBE-7010S	LB-52 LBM-52 LB-52-18		LB-78VS
	Filler and cap	KOBE-7010S			
<b>X60</b>	Root	KOBE-6010	LB-52U	LB-78VS LB-88VS	KOBE-6010 KOBE-7010S
	Hot	KOBE-7010S	LB-52 LBM-52 LB-52-18		LB-78VS LB-88VS
	Filler and cap	KOBE-7010S KOBE-8010S			
<b>X65</b>	Root	KOBE-7010S	LB-52U	LB-88VS	KOBE-7010S KOBE-8010S
	Hot	KOBE-8010S	LB-57 LB-62 LB-62D		LB-88VS
	Filler and cap	KOBE-8010S			
<b>X70</b>	Root	KOBE-7010S	LB-62U	LB-88VS	KOBE-7010S KOBE-8010S
	Hot	KOBE-8010S	LB-62 LB-62D		LB-88VS
	Filler and cap	KOBE-8010S			
<b>X80</b>	Root	-	LB-62U	LB-98VS	KOBE-7010S KOBE-8010S
	Hot		LB-65D		LB-98VS
	Filler and cap				
<b>Weldability</b>					
•Stability of root pass		○	◎	△	○
•Weld soundness		○	◎	○	○
•Crack resistance		△	◎	◎	○
<b>Welding efficiency</b>		◎	△	○	◎
<b>Groove size tolerance</b>		○	◎	△	○

Note (1) ◎: Excellent, ○: Fair, △: Inferior

## B-14

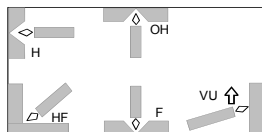
## Ilmenite type covered electrode for mild steel

**Classification:** ASME / AWS A5.1 E6019  
EN499 E352RA  
JIS Z3211 D4301

**Features :** •Suitable for butt and fillet welding of thin and middle-thick plates (up to 20mm)  
•Excellent usability

**Redrying conditions:** 70~100°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.10	0.10	0.43	0.015	0.007
Guaranty	0.05~0.13	0.05~0.25	0.25~0.65	≤0.030	≤0.025

## Mechanical properties of all-weld metal as per AWS

	YP (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	460	32	-18°C: 82
Guaranty	≥330	≥410	≥22	-18°C≥27

## Recommended welding parameters

Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F, HF, H	55~90A	85~140A	130~190A	180~260A	240~310A
VU, OH	45~75A	60~120A	100~160A	135~210A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP, DC-EN

## Approvals

AB	LR	NV	BV	NK	Others
3	3m	3	3	KMW3	CR

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.6	350	5	20	20
3.2	400	5	20	35
4.0	450	5	20	62
5.0	450	5	20	94
6.0	450	5	20	141

## RB-26

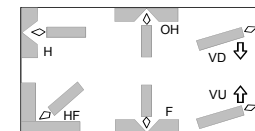
## High titania type covered electrode for mild steel

**Classification :** ASME / AWS A 5.1 E6013  
EN499 E350R  
JIS Z3211 D4313

**Features :** •Suitable for butt and fillet welding of thin plates  
•Excellent usability in all positions  
including vertical downward

**Redrying Conditions:** 70~100°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.08	0.30	0.37	0.012	0.010
Guaranty	0.05~0.12	0.15~0.45	0.25~0.65	≤0.030	≤0.025

## Mechanical properties of all-weld metal as per AWS

	YP (MPa)	TS (MPa)	El (%)
Example	450	510	25
Guaranty	≥330	≥410	≥17

## Recommended welding parameters

Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H, VD	30~65A	45~95A	60~125A	105~170A	150~220A
VU, OH	30~65A	45~95A	60~125A	100~150A	125~190A

## Polarity

Example	AC
Guaranty	AC, DC-EP, DC-EN

## Approvals

AB	LR	NK
2	2m	KMW2

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	300	2	20	10
2.6	350	5	20	19
3.2	350	5	20	29
4.0	400	5	20	53
5.0	400	5	20	81

## LB-52

Low hydrogen type covered electrode for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.1 E7016  
EN499 E423B  
JIS Z3212 D5016

**Features:** •Suitable for butt and fillet welding of heavy structures  
•Excellent mechanical properties

**Redrying Conditions:** 300~350°Cx0.5~1 h

■ **Chemical composition of all-weld metal (%) as per AWS**

	C	Si	Mn	P	S
Example	0.08	0.60	0.94	0.011	0.006
Guaranty	0.05~0.10	≤0.75	≤1.60	≤0.020	≤0.020

■ **Mechanical properties of all-weld metal as per AWS**

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	500	570	32	-29°C:120	AW
	420	520	33	-29°C:150	620×1
Guaranty	≥400	≥480	≥22	-29°C≥27	AW
	≥350	≥460	≥25	-29°C≥27	620±15x1

■ **Recommended welding parameters**

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F, HF, H	55~85A	90~130A	130~180A	180~240A	210~310A	
VU, OH	50~80A	80~120A	110~170A	150~200A	-	

■ **Polarity**

Example	AC
Guaranty	AC, DC-EP

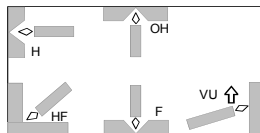
■ **Approvals**

AB	LR	NV	NK
3H10,3Y,3Y400	3m,3Ym(H15)	3YH10	KMW53HH

■ **Packages**

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	350	5	20	20
3.2	350	5	20	31
4.0	400	5	20	54
5.0	450	5	20	97
6.0	450	5	20	137

**Welding Positions**



## LB-52U

Low hydrogen type covered electrode for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.1 E7016  
EN499 E422B  
JIS Z3211 D4316

**Features :** •Suitable for one side welding of pipes  
•Extremely good arc stability in one side welding with relatively low current

**Redrying Conditions:** 300~350°Cx0.5~1 h

■ **Chemical composition of all-weld metal (%) as per AWS**

	C	Si	Mn	P	S
Example	0.08	0.64	0.86	0.012	0.008
Guaranty	0.05~0.10	≤0.75	≤1.60	≤0.020	≤0.020

■ **Mechanical properties of all-weld metal as per AWS**

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	480	560	31	-29°C: 80
Guaranty	≥400	≥480	≥22	-29°C≥27

■ **Recommended welding parameters**

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	60~90A	90~130A	130~180A	180~240A	
VU, OH	50~80A	80~120A	110~170A	150~200A	
Root pass	30~80A	60~110A	90~140A	130~180A	

Root pass: DC-EN is also suitable.

■ **Polarity**

Example	AC
Guaranty	AC, DC-EP

■ **Approvals**

AB	LR	NV	BV	NK
3H10,3Y	3m,3Ym(H15)	3YH10	3,3YHH	KMW53HH

■ **Packages**

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	350	5	20	20
3.2	400	5	20	35
4.0	400	5	20	53
5.0	400	5	20	82

## LB-52-18

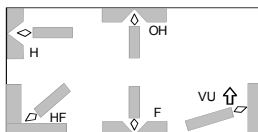
Iron powder low hydrogen type covered electrode for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.1 E7018  
EN499 E423B  
JIS Z3212 D5016

**Features :** •Suitable for butt and fillet welding of heavy structure  
•Good performance by DC-EP current

**Redrying Conditions:** 300~350°Cx0.5~1 h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.07	0.59	0.97	0.013	0.007
Guaranty	0.05~0.10	≤0.75	≤1.60	≤0.020	≤0.020

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	500	560	31	-29°C:110	AW
	420	520	32	-29°C:140	620x1
Guaranty	≥400	≥480	≥22	-29°C≥27	AW
	≥350	≥460	≥25	-29°C≥27	620±15x1

## Recommended welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	65~95A	90~130A	130~190A	190~250A	
VU, OH	60~90A	80~120A	110~170A	165~210A	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	NK
3H10,3Y	3m,3Ym(H15)	3YH10	KMW53HH

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.6	350	5	20	24
3.2	400	5	20	41
4.0	450	5	20	69
5.0	450	5	20	106

## LB-52LT-18

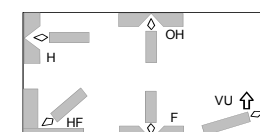
Iron powder low hydrogen type covered electrode for mild steel and 490MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.1 E7018-1

**Features:** •Suitable for butt and fillet welding of structures for low temperature service steel

**Redrying Conditions:** 300~350°Cx0.5~1 h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ti	B
Example	0.07	0.34	1.54	0.009	0.005	0.022	0.0032
Guaranty	≤0.10	≤0.75	≤1.60	≤0.020	≤0.020		

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	490	580	32	-60°C:130	AW
	470	560	32	-60°C:140	620×1
Guaranty	≥400	≥480	≥22	-45°C≥27	AW
	≥400	≥480	≥22	-45°C≥27	620±15x1

## Recommended welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	60~90A	90~130A	130~180A	180~240A	
VU, OH	50~80A	80~120A	110~170A	-	

## Polarity

Example	DC-EP
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.6	350 *	5	20	20
3.2	350	5	20	35
	450 *	5	20	39
4.0	450	5	20	68
5.0	450	5	20	105

\* : Special use for root pass

# ZERODE-43F

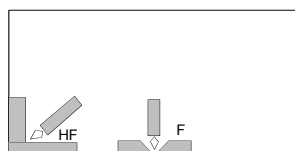
Iron-powder titania type covered electrode for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.1 E7024  
EN499 E350RR  
JIS Z3211 D4340

**Features:** •Suitable for flat and horizontal fillet welding  
•Good welding usability in manual and gravity welding

**Redrying Conditions:** 70~100°Cx0.5~1 h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.07	0.48	0.72	0.020	0.009
Guaranty	0.05~0.12	≤0.90	≤1.25	≤0.030	≤0.030

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)
Example	480	540	29
Guaranty	≥400	≥480	≥17

## Recommended welding parameters

Dia.	4.0mm	4.5mm	5.0mm	5.5mm	6.0mm	6.4mm	7.0mm
F, HF	140~ 190A	170~ 220A	200~ 250A	220~ 270A	250~ 300A	270~ 320A	300~ 350A

## Polarity

Example	AC
Guaranty	AC, DC-EP, DC-EN

## Approvals

AB	LR	NK
3	3m,3G	KMW3

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
4.0	450	5	20	81
	550	10	20	99
4.5	550	10	20	129
	700	10	20	164
5.0	550	10	20	150
	700	10	20	191
5.5	550	10	20	184
	700	10	20	234
6.0	550	10	20	208
	700	10	20	264
6.4	550	10	20	235
	700	10	20	299
7.0	550	10	20	259
	700	10	20	330



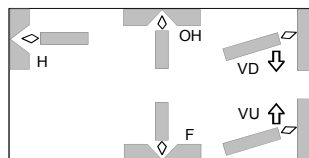
# KOBE-6010

## High cellulose type covered electrode for pipe welding (up to API-X52)

**Classification:** ASME / AWS A5.1 E6010  
EN499 E350C

**Features:** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding

### Welding Positions:



### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.12	0.15	0.51	0.009	0.008
Guaranty	0.05~0.20	≤0.40	0.30~0.80	≤0.030	≤0.025

### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	430	510	27	-29°C: 63
Guaranty	≥330	≥410	≥22	-29°C ≥27

### Recommended welding parameters

	Dia.	2.4mm	3.2mm	4.0mm	4.8mm
F, H	40~75A	70~130A	90~180A	140~225A	
VD	40~75A	70~130A	90~180A	140~225A	
VU, OH	40~75A	70~130A	90~180A	140~225A	

### Polarity

Example	DC-EP
Guaranty	DC-EP

### Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.4	300	2	20	13
3.2	350	5	20	27
4.0	350	5	20	40
4.8	350	5	20	58

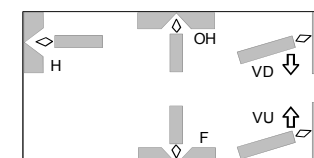
# KOBE-7010S

## High cellulose type covered electrode for pipe welding (API-X52 to X60)

**Classification:** ASME / AWS A5.5 E7010-P1  
EN499 E420C

**Features :** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding

### Welding Positions:



### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.14	0.10	1.01	0.012	0.007
Guaranty	≤0.20	≤0.60	≤1.20	≤0.03	≤0.03

### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	470	570	30	-29°C: 61
Guaranty	≥410	≥480	≥22	-29°C ≥27

### Recommended welding parameters

	Dia.	2.4mm	3.2mm	4.0mm	4.8mm
F, H	40~70A	60~120A	90~170A	130~210A	
VD	40~70A	70~120A	100~170A	150~210A	
VU, OH	40~70A	60~120A	80~160A	120~200A	

### Polarity

Example	DC-EP
Guaranty	DC-EP

### Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.4	300	2	20	13
3.2	350	5	20	26
4.0	350	5	20	40
4.8	350	5	20	58

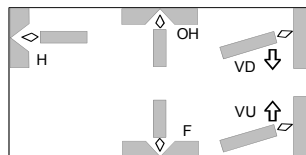
# KOBE-8010S

High cellulose type covered electrode for pipe welding (API-X60 to X70)

**Classification:** ASME / AWS A5.5 E8010-P1  
EN499 E460ZC

**Features:** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding

**Welding Positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo
Example	0.15	0.12	1.05	0.012	0.006	0.27
Guaranty	≤0.20	≤0.60	≤1.20	≤0.03	≤0.03	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	520	620	28	-29°C: 54
Guaranty	≥460	≥550	≥19	-29°C ≥27

## Recommended welding parameters

	Dia.	3.2mm	4.0mm	4.8mm
F, H	60~120A	90~170A	130~210A	
VD	70~120A	100~170A	150~210A	
VU, OH	60~120A	80~160A	120~200A	

## Polarity

Example	DC-EP
Guaranty	DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	26
4.0	350	5	20	40
4.8	350	5	20	58

# LB-78VS

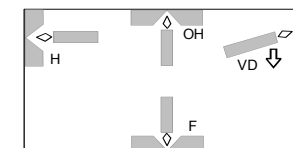
Extra low hydrogen type covered electrode for pipe welding (up to API-X60)

**Classification:** ASME / AWS A5.1 E7048  
EN499 E422B

**Features :** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding  
•Good mechanical properties

**Redrying Conditions:** 350~400°Cx1 h

**Welding Positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.06	0.56	1.18	0.012	0.005
Guaranty	0.05~0.10	≤0.90	≤1.60	≤0.020	≤0.020

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	490	580	30	-29°C:100
Guaranty	≥400	≥480	≥22	-29°C ≥27

## Recommended welding parameters

	Dia. (mm)	3.2mm	4.0mm
F, VD, H	80~140A	130~210A	
OH	80~120A	110~160A	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	33
4.0	400	5	20	56

## LB-88VS

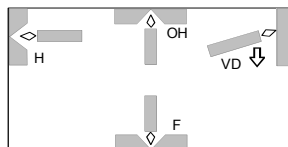
Extra low hydrogen type covered electrode for pipe welding (API-X60 to X70)

**Classification:** ASME / AWS A5.5 E8018-G  
EN499 E462ZB

**Features :** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding  
•Good mechanical properties

**Redrying Conditions:** 350~400°Cx1 h

Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.06	0.55	1.20	0.012	0.006	0.53	0.12
Guaranty	0.05~0.10	0.30~0.75	1.00~1.40	≤0.020	≤0.020	0.40~0.80	0.05~0.30

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	510	620	30	-18°C:120
Guaranty	≥460	≥550	≥19	-

## Recommended welding parameters

Dia. (mm)	3.2mm	4.0mm	4.5mm
F, VD, H	80~140A	130~200A	160~250A
OH	80~120A	110~160A	130~190A

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	31
4.0	400	5	20	56
4.5	400	5	20	68

## LB-98VS

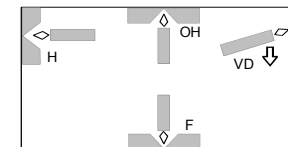
Extra low hydrogen type covered electrode for pipe welding (API-X80)

**Classification:** ASME / AWS A5.5 E9018-G  
EN499 E502ZB

**Features :** •Suitable for butt welding of pipes  
•Excellent usability in vertical downward welding  
•Good mechanical properties

**Redrying Conditions:** 350~400°Cx1 h

Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.06	0.61	1.27	0.013	0.004	1.17	0.18
Guaranty	0.05~0.10	0.30~0.75	1.00~1.50	≤0.020	≤0.020	0.90~1.40	0.10~0.40

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	560	660	30	-18°C:130
Guaranty	≥530	≥620	≥17	-

## Recommended welding parameters

Dia. (mm)	3.2mm	4.0mm	4.5mm
F, VD, H	80~140A	130~200A	160~250A
OH	80~120A	110~160A	130~190A

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	31
4.0	400	5	20	56
4.5	400	5	20	67

## DW-100

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel

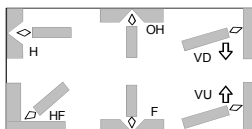
**Classification:** ASME / AWS A5.20 E71T-1  
EN 758 T 42 0 P C 1 H10  
JIS Z3313 YFW-C50DR

**Features:** •Suitable for butt and fillet welding in all positions including vertical downward  
•Soft and stable arc, less fume and spattering, smooth bead appearance, and good slag removal

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.05	0.45	1.35	0.013	0.009
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)
Example	510	570	30	-18°C: 85
Guaranty	≥400	≥490	≥22	-18°C ≥27

#### Recommended welding parameters

	1.2mm	1.4mm	1.6mm
Dia.			
F	120~300A	150~400A	180~450A
HF	120~300A	150~350A	180~400A
H	120~280A	150~320A	180~350A
VU, OH	120~260A	150~270A	180~280A
VD	200~300A	220~300A	250~300A

#### Approvals

AB	LR	NV	BV	NK	Others
2SA,2Y400S A (H10)	2S,2YS(H10)	II YMS(H10)	SA2M HH, SA2YM HH	KSW52Y40G (C)H10	GL, CCS, CR, KR

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight
1.2	Spool	12.5	1.4	Spool	12.5	1.6	Spool	12.5
	Spool	15		Spool	15		Spool	20
	Spool	20		Spool	20		Pack	350
	Pack	250		Pack	250			
				Pack	350			

## FRONTIARC-711

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel

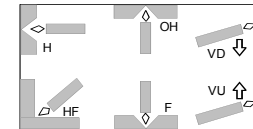
**Classification:** ASME / AWS A5.20 E71T-1/1M  
ASME / AWS A5.20 E71T-12/12M

**Features:** •Suitable for butt and fillet welding in all positions including vertical downward  
•Soft and stable arc, less fume and spattering, smooth bead appearance and good slag removal

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS (shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S
Example	0.05	0.48	1.28	0.013	0.010
Guaranty	≤0.15	≤0.90	≤1.60	≤0.03	≤0.03

#### Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)
Example	490	570	30	-29°C: 75
Guaranty	≥400	480~620	≥22	-29°C ≥27

#### Recommended welding parameters

	1.1mm	1.3mm	1.6mm
Dia.			
F	120~300A	150~400A	180~450A
HF	120~300A	150~350A	180~400A
H	120~280A	150~320A	180~350A
VU, OH	120~260A	150~270A	180~280A
VD	200~300A	220~300A	250~300A

#### Approvals

AB	LR	Others
3SA,3YSA	3S,3YS(H10)	CWB

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.1	Spool	5	1.3	Spool	12.5	1.6	Spool	12.5
	Spool	12.5		Spool	20		Spool	20
	Spool	20		Pack	250		Pack	350
	Spool	25						
	Pack	250						

## DWA-50

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel

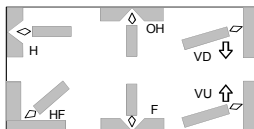
**Classification:** ASME / AWS A5.20 E71T-1M  
EN 758 T 42 2 P M 1 H5  
JIS Z3313 YFW-A50DR

**Features :** •Suitable for butt and fillet welding in all position including vertical downward  
•Excellent usability with soft and stable arc, less fume and spattering, good bead appearance and smooth slag removal

**Shielding gas:** Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.05	0.48	1.22	0.013	0.009
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	510	570	30	-18°C: 110
Guaranty	≥400	≥490	≥22	-18°C ≥ 27

#### Recommended welding parameters

	Dia.	1.2mm	1.6mm	Dia.	1.2mm	1.6mm
F	120~300A	180~450A	VU, OH	120~260A	180~280A	
HF	120~300A	180~400A	VD	200~300A	250~300A	
H	120~280A	180~350A				

#### Approvals

AB	LR	NV	BV	NK	Others
3SA,3YSA(H5)	3S,3YS(H5)	IIIYS(H5),MG	SA3YM HHH	KSW52G(M2)	GL, TÜV, U(ic), DB

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
	Spool	15
	Spool	20
	Pack	350
1.6	Spool	12.5

## DW-50

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel

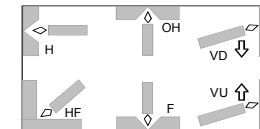
**Classification:** ASME / AWS A5.20 E71T-1/1M  
EN 758 T 42 2 P C/M 1 H5

**Features :** •Suitable for butt and fillet welding in all positions including vertical downward  
•Excellent usability with soft and stable arc, less fume and spattering, good bead appearance and smooth slag removal  
•Applicable for ship class E-grade plates

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S
Example	0.04	0.67	1.29	0.011	0.008
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

#### Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	510	582	31	-18°C: 108
Guaranty	≥400	≥490	≥22	-18°C ≥ 27

#### Recommended welding parameters

	Dia.	1.2mm	1.6mm
F	120~300A	180~450A	
HF	120~300A	180~400A	
H	120~280A	180~400A	
VU, OH	120~270A	180~280A	
VD	200~300A	250~300A	

#### Approvals

AB	LR	NV	Others
3S,3YS(H5)	3S,3YS(H5)	IIIYMS(H5)	GL

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.2	Spool	5	1.6	Spool	15
	Spool	15		Spool	20
	Spool	20		Pack	350
	Pack	250			

## MX-200

Metal type flux cored wire for mild steel and 490MPa high tensile strength steel

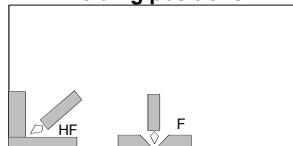
**Classification:** ASME / AWS A5.20 E70T-1  
EN 758 T 42 0 R C 3 H5  
JIS Z3313 YFW-C50DM

**Features :** •Suitable for flat and horizontal fillet welding  
•Excellent porosity resistibility to inorganic zinc primer

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.06	0.50	1.40	0.013	0.009
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	530	590	29	-18°C: 55
Guaranty	≥400	≥490	≥22	-18°C ≥27

## Recommended welding parameters

	Dia.	1.2mm	1.4mm	1.6mm
F	150~300A	170~400A	200~450A	
HF	180~300A	200~350A	270~400A	

## Approvals

AB	LR	NV	BV	NK	Others
2SA,2Y400SA (H5)	2S,2YS(H5)	II YMS(H5)	SA2YM HHH	KSW52Y40G (C)H5	GL, CCS, CR, KR

## Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5	1.4	Spool	12.5	1.6	Spool	15
	Spool	15		Spool	15		Spool	20
	Spool	20		Spool	20		Pack	350
	Pack	250		Pack	250			
				Pack	350			

## MXA-100

Metal type flux cored wire for mild steel and 490MPa high tensile strength steel

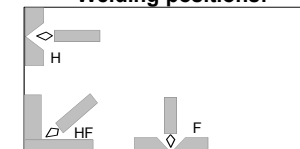
**Classification:** ASME / AWS A5.18 E70C-6M  
EN 758 T 42 4 M M 3 H5  
JIS Z3313 YFW-A50DM

**Features :** •Suitable for butt and fillet welding  
•Better arc stability and wider optimum current range for spray transfer arc with less spattering than solid wire

**Shielding gas:** Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.05	0.63	1.58	0.017	0.011
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	450	550	33	-29°C: 89
Guaranty	≥400	≥483	≥22	-29°C ≥27

## Recommended welding parameters

	Dia.	1.2mm	1.4mm	1.6mm
F	150~350A	200~450A	250~500A	
HF, H	150~300A	200~400A	250~450A	

## Approvals

LR	NV	BV	Others
3S,3YS(H5)	III YMS(H5)	SA3YM HHH	GL, TÜV, U(ic), DB

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	20
	Pack	350
1.4	Spool	20
	Pack	350
1.6	Spool	20
	Pack	350



# MX-100T

## Metal type flux cored wire for mild steel and 490MPa high tensile strength steel

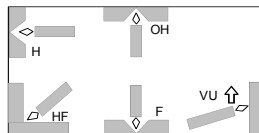
**Classification:** ASME / AWS A5.18 E70C-6C/6M  
EN 758 T 42 2 M C/M 1 H5  
JIS Z3313 YFW-C50DM

**Features :** •Suitable for butt and fillet welding in all positions for thin plates (e.g., 0.8mm)  
•Excellent arc stability in low current range (50~180A) for short circuiting welding in all positions

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

### Welding positions:



### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	20
	Pack	250
1.4	Spool	20
	Pack	250

### Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S
Example	0.08	0.49	1.53	0.013	0.015
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03

### Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	480	560	31	-29°C: 62
Guaranty	≥400	≥490	≥22	-29°C ≥27

### Recommended welding parameters

	1.2mm	1.4mm
Dia.	1.2mm	1.4mm
F, HF, H	50~300A	80~400A
VU, OH	50~180A	70~180A

### Approvals

AB	LR	NV	BV	Others
3SA,3YSA(H5)	3S,3YS(H5)	IIIYMS(H5)	SA3YM HHH	GL, CR, TÜV, U(ic)

## MG-50

Solid wire for mild steel and 490MPa high tensile strength steel

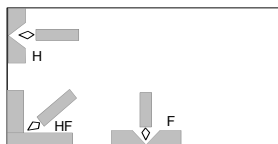
**Classification:** ASME / AWS A5.18 ER70S-G  
JIS Z3312 YGW11

**Features :** •Suitable for flat, horizontal and horizontal fillet welding  
•Higher currents are recommended

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu	Al	Ti+Zr
Example	0.04	0.73	1.64	0.010	0.010	0.23	0.01	0.22
Guaranty	≤0.15	0.55~ 1.10	1.40~ 1.90	≤0.030	≤0.030	≤0.50	≤0.10	≤0.30

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	490	570	30	-18°C: 100	AW
	420	530	34	-18°C: 110	625x1
Guaranty	≥400	≥480	≥22	-18°C≥27	AW

#### Recommended welding parameters

Dia.	1.0mm	1.2mm	1.4mm	1.6mm
F	50~220A	100~350A	150~450A	200~550A
H	50~200A	100~300A	150~350A	200~400A

#### Approvals

AB	LR	BV	NV	NK	Others
3SA,3YSA	3S,3YS(H15)	SA3M,3YM	III YMS	KSW53G	GL, CR, KR

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.0	Spool	20	1.4	Spool	10
1.2	Spool	10		Spool	15
	Spool	15		Spool	20
	Spool	20		Pack	250
	Pack	250	1.6	Spool	20
			20	Spool	20

## MG-51T

Solid wire for mild steel and 490MPa high tensile strength steel

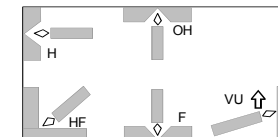
**Classification:** ASME / AWS A5.18 ER70S-6  
JIS Z3312 YGW12

**Features :** •Suitable for butt and fillet welding in all positions  
•Higher currents can be applied in vertical and overhead positions  
•Suitable for pipe welding in all positions

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of wire (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Cu
Example	0.10	0.88	1.56	0.011	0.012	0.24
Guaranty	0.06~ 0.15	0.80~ 1.10	1.40~ 1.85	≤0.025	≤0.030	≤0.50

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	Shielding gas
Example	470	560	32	-29°C: 70	CO <sub>2</sub>
	520	600	31	-29°C: 90	80%Ar-20%CO <sub>2</sub>
Guaranty	≥400	≥480	≥22	-29°C≥27	CO <sub>2</sub>

#### Recommended welding parameters

Dia.	0.9mm	1.0mm	1.2mm
F	50~200A	50~220A	80~350A
VU	50~140A	50~140A	50~160A
OH	50~120A	50~120A	50~140A

#### Approvals

AB	LR	BV	NV	NK
3SA,3YSA	3S,3YS(H15)	SA3,3YM	III YMS	KSW53G(C)

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
0.9	Spool	20	1.2	Spool	20
	Pack	250		Pack	250
1.0	Spool	20			

## TGS-50

TIG welding rod and wire for mild steel, 490MPa high tensile strength steel and aluminium-killed steel for low temperature service

**Classification:** ASME / AWS A5.18 ER70S-G

JIS Z3316 YGT50

**Features:** •Good impact value at low temperatures

**Shielding Gas:** Ar

**Polarity:** DC-EN

#### Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cu	Al	Ti	Zr
Example	0.10	0.74	1.40	0.009	0.010	0.24	0.01	0.01	0.01
Guaranty	≤0.12	≤0.95	1.00~ 1.50	≤0.025	≤0.025	≤0.50	≤0.15	≤0.15	≤0.12

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	480	580	33	-29°C: 180	AW
	380	500	36	-29°C: 230	625x8
Guaranty	≥400	≥480	≥22	-29°C≥27	AW

#### Approvals

AB	LR	NV	BV	NK	Others
3*,3Y*	3Ym(H15)	III YM	SA3YM	KSW53G	GL, CR, KR

#### Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
0.8	spool	10	-	-
1.2	spool	10	-	-
	spool	20	-	-
	tube	5	1,000	9
1.6	spool	10	-	-
	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-51T

TIG welding rod and wire for mild steel, 490MPa high tensile strength steel and aluminium-killed steel for low temperature service

**Classification:** ASME / AWS A5.18 ER70S-6

JIS Z3316 YGT50

**Features:** •Its tensile strength after long time PWHT is high enough for 490MPa

**Shielding Gas:** Ar

**Polarity:** DC-EN

#### Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cu	Al	Ti	Zr
Example	0.10	0.89	1.56	0.010	0.011	0.23	0.01	0.01	0.01
Guaranty	0.07~ 0.15	0.80~ 1.00	1.40~ 1.85	≤0.025	≤0.025	≤0.50	≤0.15	≤0.15	≤0.12

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	510	610	32	-29°C: 210	AW
	420	550	35	-29°C: 160	625x24
Guaranty	≥400	≥480	≥22	-29°C≥27	AW

#### Approvals

Others

TÜV

#### Packages

dia. (mm)	Type	Weight (kg)	Length (mm)	Weight/ piece(g)
0.8	spool	10	-	-
1.2	spool	10	-	-
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

# N065G

TIG welding rod and wire for mild steel and 490 MPa high tensile strength steel

**Classification:** ASME / AWS A5.18 ER70S-2  
JIS Z3316 YGT50

**Features:** •Suitable for root pass welding of pipes

**Shielding Gas:** Ar

**Polarity:** DC-EN

## Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cu	Al	Ti	Zr
Example	0.04	0.54	1.25	0.007	0.014	0.25	0.07	0.08	0.04
Guaranty	≤0.07	0.40~ 0.70	0.90~ 1.40	≤0.025	≤0.030	≤0.50	0.05~ 0.15	0.05~ 0.15	0.02~ 0.12

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	560	620	28	-29°C: 200	AW
	520	600	30	-29°C: 160	625x8
Guaranty	≥400	≥480	≥22	-29°C≥27	AW

## Packages

dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece(g)
0.9	spool	10	-	-
1.2	tube	5	1,000	9
1.6	spool	20	-	-
	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## G-50/US-36

## SAW flux and wire combination for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.17 F7A2-EH14  
JIS Z3183 S502-H

**Features :** •Suitable for butt and fillet welding of thin plates at high speeds  
•DC-EP (CP type power source) is better for sheet metal of 4mm or thinner

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.03	1.95	0.013	0.005	0.11
Guaranty	0.10~0.20	≤0.10	1.70~2.20	≤0.030	≤0.030	≤0.35

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.12	0.20	1.36	0.013	0.013

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	440	540	29	-29°C: 40	AW
Guaranty	≥400	480~660	≥22	-29°C≥27	AW

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
1.6	spool	10,20	8x48	can	25
2.0	spool	10,20	12x65	can	25
2.4	coil	25,76,150	12x150	can	25
	spool	10,20	20xD	can	25
3.2	coil	25,76,150			
4.0	coil	25,75,150			
4.8	coil	25,75,150			
6.4	coil	25,78,159			

## G-60/US-36

## SAW flux and wire combination for mild steel and 490MPa high tensile strength steel

**Classification:** ASME / AWS A5.17 F7A2-EH14  
JIS Z3183 S502-H

**Features:** •Suitable for butt and fillet welding of thin or medium plate at high speeds

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.03	1.95	0.013	0.005	0.11
Guaranty	0.10~0.20	≤0.10	1.70~2.20	≤0.030	≤0.030	≤0.35

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.10	0.27	1.34	0.016	0.015

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	460	560	27	-29°C: 40	AW
Guaranty	≥400	480~660	≥22	-29°C≥27	AW

## Polarity

Example	AC
Guaranty	AC

## Approvals

	AB	LR	NV	BV	NK	Others
Single	1T	1T	I T	A1T	KAW1TM	CR

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
1.6	spool	10,20	12x65	can	25
2.0	spool	10,20	12x150	can	25
2.4	coil	25,76,150			
	spool	10,20			
3.2	coil	25,76,150			
4.0	coil	25,75,150			
4.8	coil	25,75,150			
6.4	coil	25,78,159			

## MF-38/US-36

## SAW flux and wire combination for mild steel and 490MPa high tensile strength steel

**Classification :** ASME / AWS A5.17 F7A6-EH14  
F7P6-EH14

JIS Z3183 S502-H

**Features :** •Suitable for butt and flat fillet welding of medium or heavy thick plate  
•Excellent mechanical properties of weld metal by multi-pass welding

**Redrying conditions of flux:** 150~350°Cx1h

## ■ Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.03	1.95	0.013	0.005	0.11
Guaranty	0.10~0.20	≤0.10	1.70~2.20	≤0.030	≤0.030	≤0.35

## ■ Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.09	0.32	1.63	0.018	0.011

## ■ Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	490	570	30	-51°C: 59	AW
	420	530	31	-51°C: 64	620x1
Guaranty	≥400	480~660	≥22	-51°C≥27	AW
	≥400	480~660	≥22	-51°C≥27	620±15x1

## ■ Polarity

Example	AC
Guaranty	AC

## ■ Approvals

	AB	LR	NV	BV	NK	Others
Single	2T,2YT 3M,3YM	2T,2YT 3YM	II YT (III YM)	A2,2YT 3,3YM	KAW52T 53M	GL, CR, KR

## ■ Packages

Wire

Dia. (mm)	Type	Weight (kg)
1.6	spool	10,20
2.0	spool	10,20
2.4	coil	25,76,150
	spool	10,20
3.2	coil	25,76,150
4.0	coil	25,75,150
4.8	coil	25,75,150
6.4	coil	25,78,159

Flux

Mesh size	Type	Weight (kg)
12x65	can	25
20x200	can	25
20xD	can	25



# MF-300/US-36

## SAW flux and wire combination for mild steel and 490MPa high tensile strength steel

**Classification :** ASME / AWS A5.17 F7A6-EH14  
F7P6-EH14

JIS Z3183 S502-H

**Features :** •Suitable for butt and flat fillet welding of medium or heavy thick plate  
•Excellent slag removal and good mechanical properties

**Redrying conditions of flux:** 150~350°Cx1h

### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.03	1.95	0.013	0.005	0.11
Guaranty	0.10~0.20	≤0.10	1.70~2.20	≤0.030	≤0.030	≤0.35

### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.12	0.27	1.32	0.015	0.009

### Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	470	570	30	-51°C: 90	AW
	410	520	31	-51°C: 82	620x1
Guaranty	≥400	480~660	≥22	-51°C≥27	AW
	≥400	480~660	≥22	-51°C≥27	620±15x1

### Polarity

Example	AC
Guaranty	AC

### Approvals

	AB	LR	NV
Single	2T,2YT,3M,3YM	2T,2YT,3YM	II YT(III YM)

### Packages

Wire

Dia. (mm)	Type	Weight (kg)
1.6	spool	10,20
2.0	spool	10,20
2.4	coil	25,76,150
	spool	10,20
3.2	coil	25,76,150
4.0	coil	25,75,150
4.8	coil	25,75,150
6.4	coil	25,78,159

Flux

Mesh size	Type	Weight (kg)
20x200	can	25
20xD	can	25

# AF-490/US-12K

## SAW flux and wire combination for mild steel and 490MPa high tensile strength steel

**Classification :** ASME / AWS A5.17 F7A4-EM12K  
F6P6-EM12K

EN S42 4 AB S2Si

**Features :** •Suitable for butt and fillet welding  
•Excellent mechanical properties of weld metal by multi-pass welding

**Redrying conditions of flux:** 200~300°Cx1h

### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.11	0.20	0.96	0.007	0.012	0.10
Guaranty	0.05~0.15	0.10~0.35	0.80~1.25	≤0.030	≤0.030	≤0.35

### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.05	0.52	1.61	0.009	0.004

### Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	430	530	37	-40°C: 106	AW
	380	500	36	-51°C: 133	620x1
Guaranty	≥400	480~660	≥22	-40°C≥27	AW
	≥330	410~550	≥22	-51°C≥27	620±15x1


### Polarity

Example	DC-EP
Guaranty	DC-EP

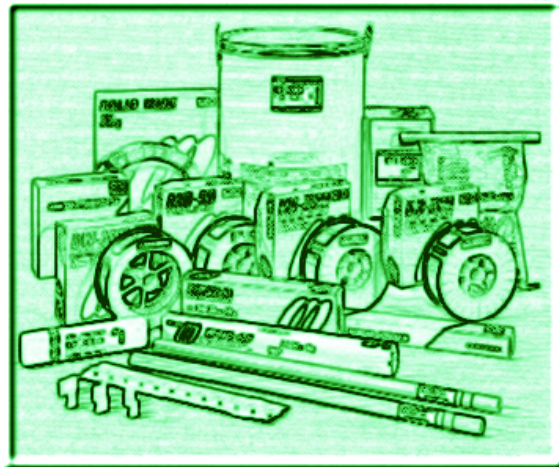
### Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	10x48	paper bag	25
4.0	coil	25			
4.8	coil	25			



Use the bookmark or click  the list mark below for details

## For 590-780MPa High Tensile Strength Steel and Low Temperature Steel



■ A guide for selecting welding consumables

### Welding consumables and proper welding conditions for

- Shielded Metal Arc Welding (SMAW)
- Flux Cored Arc Welding (FCAW)
- Gas Metal Arc Welding (GMAW)
- Submerged Arc Welding (SAW)

## For 590-780MPa High Tensile Strength Steel and Low Temperature Steel

### A guide for selecting welding consumables <sup>(1)</sup>

TS	≥490MPa	≥520MPa	≥550MPa	≥610MPa	≥670MPa	≥770MPa
YS	≥350MPa	≥400MPa	≥420MPa	≥500MPa	≥550MPa	≥690MPa
IV	≥35J	≥40J	≥42J	≥50J	≥55J	≥60J
SMAW						
-20°C	LB-52 (AC, DC-EP, SR) LB-52A (AC, DC-EP, SR)	LB-57 (AC, DC-EP, SR)	LB-62UL (AC, DC-EP, SR) LB-62 (AC, DC-EP, SR)	LB-62UL (AC, DC-EP, SR) LB-62 (AC, DC-EP, SR)	LB-106 (AC, DC-EP)	LB-80UL (AC)
-40°C	LB-52LT-18 (DC-EP, SR)	NB-1SJ (AC, DC-EP, SR) LB-52NS (AC)	NB-1SJ (AC, SR) LB-62L (AC, DC-EP, SR)	LB-62L (AC, SR)	LBY-75 (AC)	LB-88LT (AC)
-60°C	NB-1SJ (AC, DC-EP, SR) LB-52NS (AC, DC-EP, SR))					
FCAW, GMAW <sup>(2)</sup>						
-20°C	DW-100E (100%CO <sub>2</sub> ) MGS-50 (Ar-20%CO <sub>2</sub> , SR)	DW-55L (100%CO <sub>2</sub> ) DWA-55L (Ar-20%CO <sub>2</sub> ) MGT-1NS (Ar-20%CO <sub>2</sub> )	DW-55L (100%CO <sub>2</sub> ) DWA-55L (Ar-20%CO <sub>2</sub> ) MGT-1NS (Ar-20%CO <sub>2</sub> )	DWA-65L (Ar-20%CO <sub>2</sub> ) MGT-1NS (Ar-20%CO <sub>2</sub> )	MGS-70 (Ar-20%CO <sub>2</sub> )	MGS-80 (Ar-20%CO <sub>2</sub> )
-30°C	DW-55E (100%CO <sub>2</sub> ) DWA-55E (Ar-20%CO <sub>2</sub> )				—	—
-40°C	DWA-55ESR (Ar-20%CO <sub>2</sub> , SR)					
-60°C	DW-55L (100%CO <sub>2</sub> ) DWA-55L (Ar-20%CO <sub>2</sub> ) MGS-50LT (Ar-20%CO <sub>2</sub> , SR)	DW-55LSR (100%CO <sub>2</sub> , SR) DWA-55LSR (Ar-20%CO <sub>2</sub> , SR) MGS-50LT (Ar-20%CO <sub>2</sub> )	DW-55LSR (100%CO <sub>2</sub> ) DWA-55LSR (Ar-20%CO <sub>2</sub> )	—	—	MGS-88A (Ar-20%CO <sub>2</sub> )
GTAW <sup>(3)</sup>						
-20°C	TGS-50 (SR) TGS-51T (SR)	TGS-62 (SR) TGS-60A (SR)	TGS-62 (SR) TGS-60A (SR)	TGS-62 (SR) TGS-60A (SR)	TGS-80AM (SR)	TGS-80AM (SR)
-40°C	TGS-1MT TGS-1N	TGS-60A (SR)	TGS-60A (SR)	TGS-60A (SR)		
-60°C						
SAW						
-20°C	MF-300 / US-36 (AC, SR)	MF-300 / US-49A (AC, SR)	MF-300 / US-49A (AC, SR)	MF-300 / US-40 (AC, SR)	PFH-80AK / US-255 (AC)	PFH-80AS / US-80LT (DC-EP) PFH-80AK / US-80LT (AC)
-40°C	MF-300 / US-49A (AC, SR)	PFH-55S / US-49A (AC, SR)	PFH-55S / US-49A (AC, SR) PFH-80AK / US-56B (DC-EP)	PFH-55S / US-40 (AC) PFH-80AK / US-56B (AC, DC-EP)		
-50°C	PFH-55AS / US-36J (DC-EP, SR)	PFHT-55LT / US-36J (AC, SR)	PFH-55LT / US-36J (AC, SR)	PFH-80AK / US-56B (AC)		
-60°C	PFH-55LT / US-36 (AC, SR)	PFH-55LT / US-36 (AC) PFH-55AS / US-36J (DC-EP)				

Note (1) Welding consumables shown with SR are suitable for the as-welded and PWHT conditions.

(2) DW-XXX and DWA-XXX are flux-cored wires. MGS-XXX and MGT-XXX are solid wires.

(3) In one-side welding, back shielding is recommended.

## LB-62

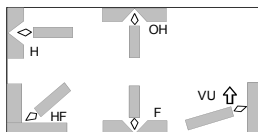
Extra low hydrogen and moisture resistant type covered electrode for  
550 to 610MPa high tensile strength steel

**Classification:** ASME / AWS A5.5 E9016-G  
EN499 E503ZB  
JIS Z3212 D5816

**Features:** •Suitable for butt and fillet welding

**Redrying Conditions:** 350~400°Cx1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.07	0.61	1.15	0.011	0.005	0.63	0.26
Guaranty	≤0.09	0.40~ 0.75	0.75~ 1.35	≤0.020	≤0.020	0.40~ 0.75	0.20~ 0.40

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	550	650	30	-18°C: 150
Guaranty	≥530	≥620	≥17	-

## Recommended welding parameters

Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F, HF, H	55~85A	90~130A	130~180A	180~240A	250~310A
VU, OH	50~80A	80~115A	110~170A	150~200A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	BV	NK	Others
3YQ500(H10)	3m,3Ym(H15)	3YH10	3,3YHH	KMW3Y50H10	CR

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	17
3.2	350	5	20	30
4.0	400	5	20	55
5.0	400	5	20	85
6.0	450	5	20	140

## LB-62UL

Ultra low hydrogen and moisture resistant type covered electrode for  
550 to 610MPa high tensile strength steel

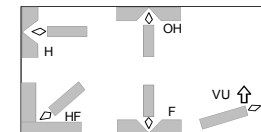
**Classification:** ASME / AWS A5.5 E9016-G  
EN499 E503ZB  
JIS Z3212 D5816

**Features :** •Suitable for butt and fillet welding

•Ultra low hydrogen type with excellent crack  
resistibility

**Redrying Conditions:** 350~430°Cx1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.07	0.63	1.13	0.010	0.006	0.65	0.25
Guaranty	≤0.09	0.40~ 0.75	0.75~ 1.35	≤0.020	≤0.020	0.45~ 0.80	0.20~ 0.40

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	550	650	30	-18°C: 160
Guaranty	≥530	≥620	≥17	-

## Recommended welding parameters

	3.2mm	4.0mm	5.0mm	6.0mm
F, HF, H	90~130A	130~180A	180~240A	250~310A
VU, OH	80~115A	110~170A	150~200A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

Others
CCS

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	31
4.0	400	5	20	55
5.0	400	5	20	85
6.0	450	5	20	140

# LB-52NS

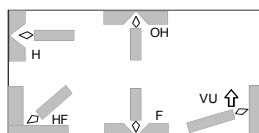
Extra low hydrogen type covered electrode for mild steel and  
490MPa high tensile strength steel for low temperature service

**Classification :** ASME / AWS A5.5 E7016-G  
JIS Z3212 D5016

**Features :** •Suitable for butt and fillet welding  
•Good CTOD properties at temperatures down to -30°C  
•Better impact values at temperatures down to -60°C

**Redrying Conditions:** 350~400°Cx1h

**Welding Positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Ti	B
Example	0.08	0.40	1.38	0.012	0.007	0.48	0.023	0.0021
Guaranty	≤0.10	0.30~ 0.90	1.00~ 1.60	≤0.020	≤0.020	0.30~ 0.70	0.005~ 0.035	0.0005~ 0.0045

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	490	580	29	-60°C: 130	AW
	470	570	31	-60°C: 120	620x1
Guaranty	≥390	≥480	≥25	-60°C≥27	AW
	≥390	≥480	≥25	-60°C≥27	620±15x1

## Recommended welding parameters

	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F, HF, H	55~85A	90~130A	130~180A	180~240A	250~310A
VU, OH	50~80A	80~120A	110~170A	150~200A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	BV	NK
3H10,3Y,MG	5Y40m(H15)	5YH10,NV2-4L,4-4L	4Y40MHH,MG	KMWL3HH

## Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
2.6	300	2	20	17
3.2	350	5	20	31
4.0	400	5	20	55
5.0	450	5	20	97
6.0	450	5	20	140

## NB-1SJ

Extra low hydrogen type covered electrode for 490 to 550MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.5 E8016-G

JIS Z3241 DL5016-6AP1

**Features :** •Suitable for butt and fillet welding of low temperature steel

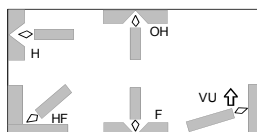
•Good CTOD properties at temperatures down to -45°C

•Good impact values at temperatures down to -80°C

•AC current is recommended for 550MPa HT class steel

**Redrying Conditions:** 350~400°Cx1h

**Welding Positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Ti	B
Example	0.08	0.31	1.32	0.007	0.004	1.33	0.020	0.0018
Guaranty	≤0.10	0.15~ 0.50	1.10~ 1.70	≤0.020	≤0.020	1.10~ 1.70	0.005~ 0.035	0.0005~ 0.0045

#### Mechanical properties of all-weld metal as AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	520	610	29	-80°C: 127	AW
	490	580	29	-80°C: 130	620x1
Guaranty	≥460	≥550	≥19	-60°C≥27	AW
	≥460	≥550	≥19	-60°C≥27	620±15x1

#### Recommended welding parameters

	3.2mm	4.0mm	5.0mm
F, HF, H	90~130A	130~180A	180~240A
VU, OH	80~120A	110~170A	150~200A

#### Polarity

Example	AC
Guaranty	AC

#### Approvals

LR	NV	BV	NK
5Y40m(H15)	5YH10,NV2-4L, 4-4L	4Y40MHH, MG	KMW5Y42H10

#### Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
3.2	350	5	20	31
4.0	400	5	20	55
5.0	450	5	20	97

## LB-62L

Extra low hydrogen and moisture resistant type covered electrode for 550 to 610MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.5 E8016-C1

**Features :** •Suitable for butt and fillet welding

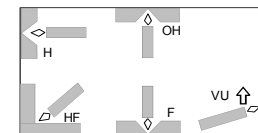
•Good CTOD properties at temperatures down to -10°C

•Better impact values at temperatures down to -60°C

•AC current is recommended for 570 to 610MPa class steel

**Redrying Conditions:** 350~400°Cx1h

**Welding Positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo	Ti	B
Example	0.07	0.34	0.97	0.012	0.005	2.10	0.13	0.022	0.0016
Guaranty	≤ 0.10	≤ 0.60	≤ 1.20	≤ 0.03	≤ 0.03	2.00~ 2.75	-	-	-

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	540	650	27	-60°C: 130	AW
	530	640	28	-60°C: 120	608x1
Guaranty	≥460	≥550	≥19	-60°C≥27	AW
	≥460	≥550	≥19	-60°C≥27	605±15x1

#### Recommended welding parameters

	3.2mm	4.0mm	5.0mm
F, HF, H	90~130A	130~180A	180~240A
VU, OH	80~120A	100~170A	-

#### Polarity

Example	AC
Guaranty	AC, DC-EP

#### Approvals

AB
5YQ500(H10)

#### Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton (kg)	Weight per piece (g)
3.2	350	5	20	31
4.0	400	5	20	55
5.0	450	5	20	97

# LB-88LT

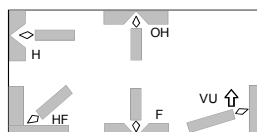
Ultra low hydrogen and moisture resistant type covered electrode for 780MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.5 E11016-G  
JIS Z3212 D8016

**Features :** •Suitable for butt and fillet welding  
•Good impact values at temperatures down to -80°C  
•Ultra low hydrogen type with excellent crack resistibility

**Redrying Conditions:** 350~430°Cx1h

**Welding Positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.04	0.58	1.81	0.012	0.006	2.62	0.73
Guaranty	≤0.09	0.40~0.75	1.40~2.00	≤0.020	≤0.020	2.10~2.80	0.50~0.80

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	750	840	20	-80°C: 63
Guaranty	≥670	≥760	≥15	-80°C ≥27

## Recommended welding parameters

	3.2mm	4.0mm	5.0mm
F, HF, H	90~130A	130~180A	180~240A
VU, OH	80~115A	100~170A	-

## Polarity

Example	AC
Guaranty	AC

## Approvals

NV
5Y69H5

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
3.2	350	5	20	30
4.0	400	5	20	54
5.0	400	5	20	87



## DW-100E

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel for low temperature service

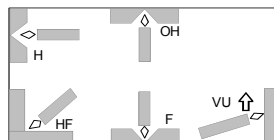
**Classification:** ASME / AWS A5.20 E71T-9  
EN 758 T 42 2 P C 1 H10  
JIS Z3313 YFW-C502R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -29°C

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.05	0.43	1.28	0.013	0.008	0.38
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03	≤0.50

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)
Example	510	570	29	-29°C: 100
Guaranty	≥400	≥480	≥22	-29°C ≥ 27

#### Recommended welding parameters

Dia.	1.2mm	1.4mm
HF	120~300A	150~350A
VU, OH	120~250A	150~250A

#### Approvals

AB	LR	NV	BV	NK	Others
3SA, 3Y400SA (H10)	3S,3YS(H10)	III YMS	SA3,3YM	KSW53G	GL, CCS

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
	Spool	15
	Spool	20
1.4	Spool	12.5
	Spool	15

## DW-55E

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel for low temperature service

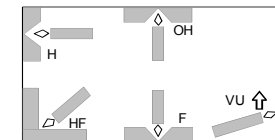
**Classification:** ASME / AWS A5.20 E71T-9J  
EN 758 T42 4 P C 1 H5  
JIS Z3313 YFL-C504R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -40°C

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.05	0.40	1.42	0.012	0.010	0.41
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03	≤0.50

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)
Example	540	590	29	-40°C: 80
Guaranty	≥400	≥480	≥22	-40°C ≥ 27

#### Recommended welding parameters

Dia.	1.2mm	1.4mm
F	150~300A	150~400A
HF	150~300A	150~350A
H	150~280A	150~300A
VU, OH	150~250A	150~250A

#### Approvals

AB	LR	NV	BV	NK	Others
3SA, 3Y400SA (H5)	4Y40S(H5)	III YMS(H5)	SA3,SA3YM HHH	KSW54Y40G (C)H5	GL, CR

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5	1.4	Spool	15
	Spool	15		Spool	20
	Spool	20			

## DWA-55E

Rutile type flux cored wire for mild steel and 490MPa high tensile strength steel for low temperature service

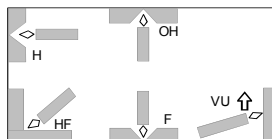
**Classification :** ASME / AWS A5.20 E71T-9MJ  
EN 758 T42 4 P M 1 H5  
JIS Z3313 YFL-A504R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -40°C

**Shielding gas:** 80%Ar-20%CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.05	0.54	1.31	0.013	0.009	0.34
Guaranty	≤0.18	≤0.90	≤1.75	≤0.03	≤0.03	≤0.50

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	540	600	28	-40°C: 100
Guaranty	≥400	≥480	≥22	-40°C ≥27

#### Recommended welding parameters

Dia.	1.2mm
F	150~300A
HF	150~300A
H	150~280A
VU, OH	150~250A

#### Approvals

AB	LR	NV	BV	Others
4Y400SA,H5	4Y40S(H5)	IVYMS(H5)	SA3YM HHH	GL, TÜV, U(ic)

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
	Spool	15

## DW-55L

Rutile type flux cored wire for mild steel and 490-550MPa high tensile strength steel for low temperature service

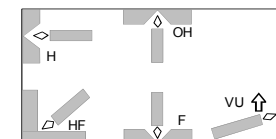
**Classification :** ASME / AWS A5.29 E81T1-K2  
EN 758 T46 6 1.5Ni P C 1 H5  
JIS Z3313 YFL-C506R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -60°C

**Shielding gas :** CO<sub>2</sub>

**Polarity :** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.04	0.38	1.32	0.010	0.008	1.40
Guaranty	≤0.15	≤0.80	0.50~ 1.75	≤0.03	≤0.03	1.00~ 2.00

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	550	620	27	-60°C: 70
Guaranty	≥470	550~690	≥22	-60°C ≥27

#### Recommended welding parameters

Dia.	1.2mm	1.4mm
F	150~300A	150~400A
HF	150~300A	150~350A
H	150~280A	150~300A
VU, OH	150~250A	150~250A

#### Approvals

AB	LR	NV	BV	NK	Others
3SA,3YSA, MG	5Y40S(H15)	VYMS(H10), NV2-4,4-4	SA3YMHH,MG	KSWL3G(C)	GL, CCS, KR

#### Packages

Dia. (mm)	Type	Weight (kg)	Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5	1.4	Spool	12.5
	Spool	15		Spool	15
	Spool	20			

## DWA-55L

Rutile type flux cored wire for mild steel and 490-550MPa high tensile strength steel for low temperature service

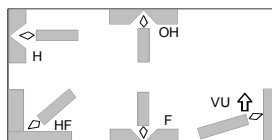
**Classification:** ASME / AWS A5.29 E81T1-K2M  
EN 758 T46 6 1.5Ni P M 1 H5  
JIS Z3313 YFL-A506R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -60°C

**Shielding gas:** 80%Ar-20%CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.03	0.48	1.25	0.009	0.008	1.44
Guaranty	≤0.15	≤0.80	0.50~1.75	≤0.03	≤0.03	1.00~2.00

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	540	600	28	-60°C: 70
Guaranty	≥470	550~690	≥22	-60°C ≥ 27

#### Recommended welding parameters

Dia.	1.2mm
F	150~300A
HF	150~300A
H	150~280A
VU, OH	150~250A

#### Approvals

AB	LR	NV
3SA,3YSA, MG	5Y46S(H5)	VY46MS(H5), NV2-4,4-4

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	15

## DWA-65L

Rutile type flux cored wire for 550-620MPa high tensile strength steel for low temperature service

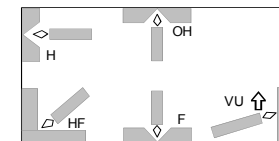
**Classification:** ASME / AWS A5.29 E91T1-K2MJ  
EN 12535 T55 4 Z P M 2 H5

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -40°C

**Shielding gas:** 80%Ar-20%CO<sub>2</sub> mixture

**Polarity:** DC-EP

**Welding positions:**



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo
Example	0.05	0.32	1.18	0.009	0.008	1.78	0.11
Guaranty	≤0.15	≤0.80	0.50~1.75	≤0.03	≤0.03	1.00~2.00	≤0.35

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	600	660	25	-40°C: 80
Guaranty	≥540	620~760	≥17	-40°C ≥ 27

#### Recommended welding parameters

Dia.	1.2mm
F, HF	150~300A
H	150~280A
VU, OH	150~250A

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	15

## DW-55LSR

Rutile type flux cored wire for mild steel and 490-550MPa high tensile strength steel for low temperature service

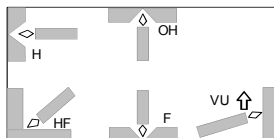
**Classification:** ASME / AWS A5.29 E81T1-K2  
EN 758 T46 6 1.5Ni P C 1 H5  
JIS Z3313 YFL-C506R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -60°C in the as-welded and PWHT conditions

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

Welding positions



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.04	0.36	1.37	0.008	0.008	1.40
Guaranty	≤0.15	≤0.80	0.50~1.75	≤0.03	≤0.03	1.00~2.00

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C <sub>xh</sub> )
Example	550	585	28	-60°C: 100	AW
	460	560	33	-60°C: 80	620x1
Guaranty	≥470	550~690	≥22	-60°C ≥27	AW

#### Recommended welding parameters

Dia.	1.2mm
F	150~300A
HF	150~300A
H	150~280A
VU, OH	150~250A

#### Approvals

LR	NV	BV	NK
5Y42S,5Y42srS (H10),MG	VY42MS (H10),MG, NV2-4L,4-4L	SA4Y40M HH,MG	KSW5Y42G (C)H10,MG

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
	Spool	15

## DWA-55LSR

Rutile type flux cored wire for mild steel and 490-550 MPa high tensile strength steel for low temperature service

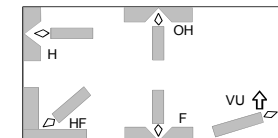
**Classification:** ASME / AWS A5.29 E81T1-Ni1M  
EN 758 T46 6 Z P M 1 H5  
JIS Z3313 YFL-A506R

**Features :** •Suitable for butt and fillet welding in all positions  
•Excellent impact value at low temperatures down to -60°C in the as-welded and PWHT conditions

**Shielding gas:** 80%Ar-20%CO<sub>2</sub> mixture

**Polarity:** DC-EP

Welding positions:



#### Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni
Example	0.05	0.33	1.32	0.009	0.008	0.90
Guaranty	≤0.12	≤0.80	≤1.50	≤0.03	≤0.03	0.80~1.10

#### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C <sub>xh</sub> )
Example	510	570	29	-60°C: 120	AW
	450	530	33	-60°C: 70	620x2
Guaranty	≥470	550~690	≥22	-60°C ≥27	AW

#### Recommended welding parameters

Dia.	1.2mm
F&HF	150~300A
H	150~280A
VU, OH	150~250A

#### Approvals

AB	LR	NV
5YQ420SA (H5)	5Y42S(H5)	VY42MS(H5), NV2-4L,4-4L

#### Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	15

# MG-60

## Solid wire for 590MPa high tensile strength steel

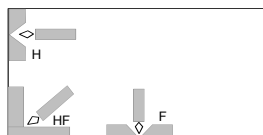
**Classification:** ASME / AWS A5.28 ER80S-G  
JIS Z3312 YGW21

**Features:** •Suitable for flat, horizontal and horizontal fillet welding

**Shielding gas:** CO<sub>2</sub>

**Polarity:** DC-EP

### Welding positions:



### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu	Al	Ti+Zr
Example	0.04	0.85	1.95	0.007	0.010	0.32	0.23	0.01	0.20
Guaranty	≤0.12	0.60~ 1.00	1.65~ 2.15	≤0.025	≤0.025	0.20~ 0.50	≤0.50	≤0.10	≤0.30

### Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	590	670	28	-18°C: 90	AW
	570	660	29	-18°C: 80	620x5
Guaranty	≥470	≥550	≥19	-18°C ≥27	AW

### Recommended welding parameters

Dia.	1.2mm	1.4mm	1.6mm
F	100~350A	150~450A	200~550A
H	100~300A	150~350A	200~400A

### Approvals

NV	NK
ⅢY46MS, MG	KSW3Y50G (C)H5

### Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	20
	Pack	250
1.2	Spool	10
	Spool	20
	Pack	250
1.4	Spool	20
1.6	Spool	20

# MF-38/US-49

## SAW flux and wire combination for 550 to 590MPa high tensile strength steel

**Classification:** ASME / AWS A5.23 F8A4-EG-A4  
F8P6-EG-A4

JIS Z3183 S584-H

**Features :** •Suitable for butt and fillet welding  
•Applicable for 0.5%Mo steel

**Redrying conditions of flux:** 150~350°Cx1h

### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.09	0.03	1.58	0.014	0.013	0.52	0.10
Guaranty	0.07~ 0.12	≤0.05	1.25~ 1.80	≤0.025	≤0.025	0.45~ 0.60	≤0.35

### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.10	0.37	1.35	0.014	0.014	0.53	-
Guaranty	≤0.15	≤0.80	≤1.60	≤0.030	≤0.030	0.40~ 0.65	≤0.35

### Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	520	640	28	-40°C: 37	AW
	510	600	29	-51°C: 40	600x3
Guaranty	≥470	550~690	≥20	-40°C≥27	AW
	≥470	550~690	≥20	-51°C≥27	620±15x1

### Polarity

Example	AC
Guaranty	AC

### Approvals

	AB	LR	NV	BV	NK
Single	3YTM	3T,3YM,3YT	ⅢYTM	A3YTM	KAW3Y46TMH10

### Packages

#### Wire

Dia. (mm)	Type	Weight (kg)
1.6	spool	10,20
2.0	spool	10,20
2.4	coil	25
	spool	10,20
3.2	coil	25,76
4.0	coil	25, 75
4.8	coil	25,75
6.4	coil	25

#### Flux

Mesh size	Type	Weight (kg)
12x65	can	25
20x200	can	25
20xD	can	25

## MF-38 / US-A4

## SAW flux and wire combination for 550 to 590MPa high tensile strength steel

**Classification :** ASME / AWS A5.23 F8A4-EA4-A4  
F8P6-EA4-A4

JIS Z3183 S584-H

**Features :** •Suitable for butt and fillet welding  
•Applicable for 0.5%Mo steel

**Redrying conditions of flux:** 150~350°Cx1h

## ■ Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.09	0.04	1.59	0.010	0.014	0.52	0.10
Guaranty	0.05~ 0.15	≤0.20	1.20~ 1.70	≤0.025	≤0.025	0.45~ 0.65	≤0.35

## ■ Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.10	0.39	1.35	0.013	0.013	0.52	0.11
Guaranty	≤0.15	≤0.80	≤1.60	≤0.030	≤0.030	0.40~ 0.65	≤0.35

## ■ Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	520	640	28	-40°C: 37	AW
	510	600	29	-51°C: 40	620x1
Guaranty	≥470	550~690	≥20	-40°C≥27	AW
	≥470	550~690	≥20	-51°C≥27	620±15x1

## ■ Polarity

Example	AC
Guaranty	AC

## ■ Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	12x65	can	25
4.0	coil	25	20x200	can	25
4.8	coil	25	20xD	can	25

## MF-38 / US-40

## SAW flux and wire combination for 550 to 610MPa high tensile strength steel

**Classification :** ASME / AWS A5.23 F9A6-EA3-A3  
F8P6-EA3-A3

JIS Z3183 S624-H1

**Features :** •Suitable for butt and fillet welding  
•Applicable for 0.5%Mo steel

**Redrying conditions of flux:** 150~350°Cx1h

## ■ Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.13	0.04	1.80	0.008	0.010	0.52	0.12
Guaranty	0.05~ 0.17	≤0.20	1.65~ 2.20	≤0.025	≤0.025	0.45~ 0.65	≤0.35

## ■ Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.08	0.34	1.58	0.017	0.009	0.45	0.12
Guaranty	≤0.15	≤0.80	≤2.10	≤0.030	≤0.030	0.40~0.65	≤0.35

## ■ Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	580	670	28	-51°C: 51	AW
	560	630	29	-51°C: 58	620X1
Guaranty	≥540	620~760	≥17	-51°C≥27	AW
	≥470	550~690	≥20	-51°C≥27	620±15x1

## ■ Polarity

Example	AC
Guaranty	AC

## ■ Approvals

	AB	NK
Single	MG	KAW3Y50MH10

## ■ Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
2.0	spool	20	12x65	can	25
2.4	coil	25	20x200	can	25
3.2	coil	25,75,150	20xD	can	25
4.0	coil	25,75			
4.8	coil	25,75,150			
6.4	coil	25			

## PFH-80AK/US-80LT

## SAW flux and wire combination for 780MPa high tensile strength steel

**Classification:** ASME / AWS A5.23 F12A10-EG-G**Features :** •Suitable for butt and flat fillet welding of heavy duty structures

•AC current is only applicable

•Excellent impact value at low temperatures down to -80°C

**Redrying conditions of flux:** 250~350°Cx1h

## ■ Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo	Cu
Example	0.12	0.15	2.03	0.007	0.002	2.75	0.77	0.10
Guaranty	≤0.15	≤0.25	1.75~ 2.25	≤0.015	≤0.015	2.40~ 2.90	0.60~ 0.90	≤0.40

## ■ Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo	Cu
Example	0.08	0.28	1.65	0.009	0.004	2.45	0.74	0.12
Guaranty	≤0.12	≤0.80	1.20~ 2.20	≤0.030	≤0.030	2.10~ 2.90	0.50~ 1.00	≤0.35

## ■ Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT
Example	760	840	22	-73°C: 90	AW
Guaranty	≥750	830~970	≥14	-73°C≥27	AW

## ■ Polarity

Example	AC
Guaranty	AC

## ■ Approvals

	NV
Single	VY69M

## ■ Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	10x48	can	20
4.0	coil	25			
4.8	coil	25			

## PFH-80AS/US-80LT

## SAW flux and wire combination for 780MPa high tensile strength steel

**Classification:** ASME / AWS A5.23 F11A10-EG-G**Features :** •Suitable for butt and flat fillet welding of heavy duty structures

•DC-EP current is only applicable

•Excellent impact value at low temperatures down to -80°C

**Redrying conditions of flux:** 250~350°Cx1h

## ■ Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo	Cu
Example	0.12	0.15	2.03	0.007	0.002	2.75	0.77	0.10
Guaranty	≤0.15	≤0.25	1.75~ 2.25	≤0.015	≤0.015	2.40~ 2.90	0.60~ 0.90	≤0.40

## ■ Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Mo	Cu
Example	0.06	0.51	1.64	0.011	0.002	2.42	0.73	0.11
Guaranty	≤0.12	≤0.80	1.20~ 2.20	≤0.030	≤0.030	2.10~ 2.90	0.50~ 1.00	≤0.35

## ■ Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT
Example	740	860	23	-73°C: 83	AW
Guaranty	≥680	760~900	≥15	-73°C≥27	AW

## ■ Polarity

Example	DC-EP
Guaranty	DC-EP

## ■ Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	10x48	can	20
4.0	coil	25			
4.8	coil	25			



## PFH-55LT/US-36

SAW flux and wire combination for mild steel and 490MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.17 F7A8-EH14, F7P8-EH14

**Features :** •Suitable for butt welding of structures for low temperature service

•AC current is only applicable

•Excellent impact value at low temperatures down to -60°C and

CTOD at temperatures down to -50°C

**Redrying conditions of flux:** 200~300°Cx1h

#### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.03	1.95	0.013	0.008	0.08
Guaranty	0.10~0.18	≤0.05	1.70~2.20	≤0.030	≤0.030	≤0.30

#### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Ti	B
Example	0.08	0.19	1.42	0.013	0.005	0.02	0.004

#### Mechanical properties of weld metal as per AWS

	0.2%OS MPa	TS Mpa	EI %	IV J	PWHT (°C)hrs
Example	489	555	34	-62°C: 180	AW
	461	539	34	-62°C: 160	623x1
Guaranty	≥400	480~660	≥22	-62°C≥27	AW
	≥400	480~660	≥22	-62°C≥27	620±15x1

#### Polarity

Example	AC
Guaranty	AC

#### Approvals

	AB	LR	NV	BV	NK
Single	3M,3YM,MG	5Y40M(H5)	V YM,NV2-4,4-4	A4YM,MG	KAWL3M
Tandem	4YM,MG	-	V YM	-	-

#### Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25,76,150	10x48	can	20
4.0	coil	25,75,150			
4.8	coil	25,75,150			

## PFH-55AS/US-36J

SAW flux and wire combination for mild steel and 490MPa high tensile strength steel for low temperature service

**Classification:** ASME / AWS A5.17 F7A8-EH14, F7P8-EH14

**Features :** •Suitable for butt welding of structures for low temperature service

•DC-EP current is only applicable

•Excellent impact value at low temperatures down to -60°C and

CTOD at temperatures down to -20°C

**Redrying conditions of flux:** 200~300°Cx1h

#### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.13	0.01	2.00	0.012	0.007	0.08
Guaranty	0.10~0.18	≤0.05	1.70~2.20	≤0.030	≤0.030	≤0.30

#### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Ti	B
Example	0.07	0.23	1.42	0.009	0.004	0.02	0.004

#### Mechanical properties of weld metal as per AWS

	0.2%OS MPa	TS Mpa	EI %	IV J	PWHT (°C)h
Example	485	555	33	-62°C: 170	AW
	432	532	31	-62°C: 180	620x1
Guaranty	≥400	480~660	≥22	-62°C≥27	AW
	≥400	480~660	≥22	-62°C≥27	620±15x1

#### Polarity

Example	DC-EP
Guaranty	DC-EP

#### Approvals

	AB	LR
Single	5Y400H5	5Y40MH5

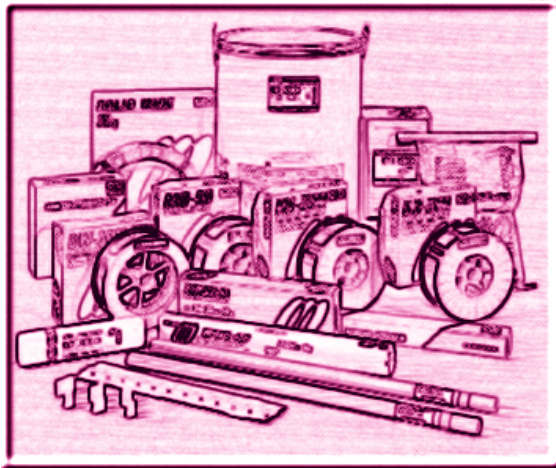
#### Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	10x48	can	20
4.0	coil	25			
4.8	coil	25			



Use the bookmark or click  
the list mark below for details

## For Heat-Resistant Low-Alloy Steel



■ A guide for selecting  
welding consumables

### Welding consumables and proper welding conditions for

- Shielded Metal Arc Welding (SMAW)
- Flux Cored Arc Welding (FCAW)
- Gas Tungsten Arc Welding (GTAW)
- Submerged Arc Welding (SAW)

## For Heat-Resistant Low-Alloy Steel

### A guide for selecting welding consumables

Steel type	ASTM / ASME steel grade		SMAW	FCAW	GMAW	GTAW	SAW
	Plate	Pipe / Tube					
Mn-Mo Mn-Mo-Ni	A302Gr.B,C,D A533Type A,B,C,D	-	BL-96 BL-106	-	MGS-56 MGS-63S	TGS-56	MF-27/US-56B PF-200/US-56B PF-200/US-63S
0.5Mo	A204Gr.A,B,C	A209Gr.T1 A335Gr.P1	CMA-76	-	MGS-M MG-M	TGS-M	MF-38/US-40 MF-38/US-49 MF-38/US-A4
0.5Cr-0.5Mo	A387Gr.2 Cl.1,2	A213Gr.T2 A335Gr.P2	CMB-83 CMB-86	-	MG-CM	TGS-CM	-
1Cr-0.5Mo 1.25Cr-0.5Mo	A387Gr.12 Cl.1,2 A387Gr.11 Cl.1,2	A213Gr.T11,12 A335Gr.P11,12	CMA-96 CMA-96MB CMB-95 CMB-98	DW-81B2 DWA-81B2	MGS-1CM MG-1CM	TGS-1CM TGS-1CML	MF-29A/US-511 PF-200/US-511N
2.25Cr-1Mo	A387Gr.22 Cl.1,2	A213Gr.T22 A335Gr.P22	CMA-106 CMA-106N CMB-105 CMB-108	DW-91B3 DWA-91B3	MGS-2CM MGS-2CMS MG-2CM	TGS-2CM TGS-2CML	MF-29A/US-521 PF-200/US-521S
2.25Cr-1Mo-V	A542Type D Cl.4a A832Gr.22V	-	CMA-106H CMA-106HD	-	-	TGS-2CMH	PF-500/US-521H PF-500D/US-521HD
5Cr-0.5Mo	A387Gr.5 Cl.1,2	A213Gr.T5 A335Gr.P5	CM-5	-	MGS-5CM	TGS-5CM	PF-200S/US-502
9Cr-1Mo	A387Gr.9 Cl.1,2	A213Gr.T9 A335Gr.P9	CM-9	-	MGS-9CM	TGS-9CM	-
9Cr-1Mo-V-Nb	A387Gr.91 Cl.2	A213Gr.T91 A335Gr.P91	CM-9Cb CM-96B9	-	MGS-9Cb	TGS-9Cb TGS-90B9	PF-200S/US-9Cb
Low C 2.25Cr-W-V-Nb	-	(SA213Gr.T23) (SA335Gr.P23)	CM-2CW	-	-	TGS-2CW	-

## CMA-96

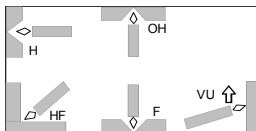
Low hydrogen type covered electrode for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.5 E8016-B2  
JIS Z3223 DT2316

**Features :** •Suitable for butt and fillet welding  
•Applicable for ASTM A387 Gr.11, Gr.12 and equivalents

**Redrying Conditions:** 325~375°Cx1h

## Welding Positions



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo
Example	0.06	0.38	0.72	0.008	0.004	1.31	0.54
Guaranty	0.05~0.12	≤0.60	≤0.90	≤0.03	≤0.03	1.00~1.50	0.40~0.65

## Mechanical properties of all-weld metal as per AWS

	Temp. (°C)	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	RT	570	650	26	0°C: 210	690x1
	450	460	520	21	-	
Guaranty	RT	≥460	≥550	≥19	-	690±15x1

## Recommended welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F	55~85A	80~120A	125~175A	185~235A	240~300A	
VU, OH	50~80A	75~110A	100~160A	-	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	BV	NK	Others
MG(E8016-B2)	MG(E8016-B2)	H10, NV1Cr0.5Mo	MG(E8016-B2)	MG(E8016-B2)	TÜV

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	17
3.2	350	5	20	29
4.0	400	5	20	53
5.0	400	5	20	82
6.0	400	5	20	122

## CMA-96MB

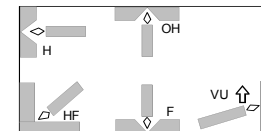
Low hydrogen type covered electrode for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.5 E8016-B2  
JIS Z3223 DT2316

**Features :** •Suitable for butt and fillet welding  
•Applied for ASTM A387 Gr.11, Gr.12 and equivalents  
•Lower tensile strength and higher impact value

**Redrying Conditions:** 325~375°Cx1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo
Example	0.06	0.45	0.74	0.007	0.003	1.30	0.54
Guaranty	0.05~0.12	≤0.60	≤0.90	≤0.03	≤0.03	1.00~1.50	0.40~0.65

## Mechanical properties of all-weld metal as per AWS

	Temp. (°C)	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	PWHT (°C×h)
Example	RT	490	590	30	-18°C: 200	690x1
	450	360	450	24	-18°C: 170	690x1 + Step Cooling
Guaranty	RT	≥460	≥550	≥19	-	690±15x1

## Recommended welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F	55~85A	80~120A	125~175A	185~235A	240~300A	
VU, OH	50~80A	75~110A	100~160A	-	-	

## Polarity

Example	AC
Guaranty	AC

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	17
3.2	350	5	20	30
4.0	400	5	20	54
5.0	400	5	20	84
6.0	400	5	20	120

## CMA-106

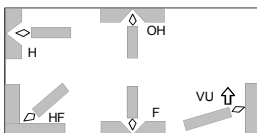
Low hydrogen type covered electrode for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.5 E9016-B3  
JIS Z3223 DT2416

**Features :** •Suitable for butt and fillet welding  
•Applicable for ASTM A387 Gr.22 and equivalents

**Redrying Conditions:** 325~375°Cx1h

**Welding Positions:**



**Chemical composition of all-weld metal (%) as per AWS**

	C	Si	Mn	P	S	Cr	Mo
Example	0.07	0.34	0.61	0.006	0.004	2.10	0.96
Guaranty	0.05~ 0.12	≤0.60	≤0.90	≤0.03	≤0.03	2.00~ 2.50	0.90~ 1.20

**Mechanical properties of all-weld metal as per AWS**

	Temp. (°C)	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	RT	630	730	22	0°C: 120	690x1
	450	520	580	17	-	
Guaranty	RT	≥530	≥620	≥17	-	690±15x1

**Recommended welding parameters**

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F	55~85A	90~130A	140~190A	190~240A	240~300A	
VU, OH	50~80A	75~115A	100~160A	-	-	

**Polarity**

Example	AC
Guaranty	AC, DC-EP

**Approvals**

AB	LR	NV	BV	NK	Others
MG(E9016-B3)	MG(E9016-B3)	H10, NV2.25Cr1Mo	MG(E9016-B3)	MG(E9016-B3)	TÜV

**Packages**

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	17
3.2	350	5	20	30
4.0	400	5	20	55
5.0	400	5	20	85
6.0	400	5	20	121

## CMA-106N

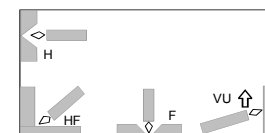
Low hydrogen type covered electrode for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.5 E9016-B3  
JIS Z3223 DT2416

**Features :** •Suitable for butt and fillet welding  
•Applied for ASTM A387 Gr.22 and equivalents  
•Lower tensile strength, higher impact value and less sensitive to temper embrittlement compared with **CMA-106**

**Redrying Conditions:** 325~375°Cx1h

**Welding Positions:**



**Chemical composition of all-weld metal (%) as per AWS**

	C	Si	Mn	P	S	Cr	Mo
Example	0.11	0.33	0.81	0.005	0.002	2.28	0.98
Guaranty	0.05~ 0.12	≤0.60	≤0.90	≤0.03	≤0.03	2.00~ 2.50	0.90~ 1.20

**Mechanical properties of all-weld metal as per AWS**

	Temp. (°C)	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	RT	510	650	28	-29°C: 120	690x8
	450	430	510	20	-29°C: 110	690x8 + Step Cooling
Guaranty	RT	≥530	≥620	≥17	-	690±15x1

**Recommended welding parameters**

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm	6.0mm
F	55~85A	90~130A	140~190A	190~240A	240~300A	
VU	50~80A	75~115A	100~160A	-	-	

**Polarity**

Example	AC
Guaranty	AC

**Packages**

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	18
3.2	350	5	20	31
4.0	400	5	20	55
5.0	400	5	20	86
6.0	400	5	20	122

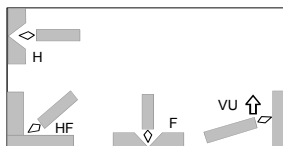
## CMA-106H

Low hydrogen type covered electrode for 2.25%Cr-1%Mo-V heat resistant steel

**Features :** •Suitable for butt and fillet welding  
•Applied for ASTM A336 Gr F22V and equivalents  
•Excellent tensile strength at high temperatures and good creep rupture strength

Redrying Conditions: 325~375°Cx1h

Welding Positions:



Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	V	Nb
Example	0.08	0.31	1.18	0.004	0.001	2.42	1.01	0.29	0.017
Guaranty	0.05~ 0.12	0.20~ 0.50	0.50~ 1.30	≤0.015	≤0.015	2.00~ 2.60	0.90~ 1.20	0.20~ 0.40	0.010~ 0.040

Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	612	713	23	-18°C: 147	705x7
Guaranty	≥420	≥590	≥18	-	705±15x8

Recommended welding parameters

Dia.	3.2mm	4.0mm	5.0mm
F	90~130A	140~190A	190~240A
VU	75~115A	100~160A	-

Polarity

Example	AC
Guaranty	AC

Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
3.2	350	5	20	32
4.0	400	5	20	56
5.0	400	5	20	87

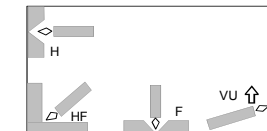
## CMA-106HD

Low hydrogen type covered electrode for 2.25%Cr-1%Mo-V heat resistant steel

**Features :** •Suitable for butt and fillet welding  
•Applicable for ASTM A336 Gr F22V and equivalents  
•Excellent tensile strength at high temperatures and good creep rupture strength by DC-EP current

Redrying Conditions: 325~375°Cx1h

Welding Positions:



Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	V	Nb
Example	0.08	0.24	1.12	0.005	0.002	2.48	1.05	0.27	0.012
Guaranty	0.05- 0.15	0.20- 0.50	0.50- 1.30	≤0.015	≤0.015	2.00- 2.60	0.90- 1.20	0.20- 0.40	0.010- 0.040

Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	520	636	24	-30°C: 130	*1
Guaranty	≥420	≥590	≥18	-	705±15x8

\*1: 705°Cx 8h for impact test, 705°Cx 26h for tensile test

Recommended welding parameters

Dia.	3.2mm	4.0mm	5.0mm
F	90~130A	140~190A	190~240A
VU	75~115A	100~160A	-

Polarity

Example	DC-EP
Guaranty	DC-EP

Packages

Dia. (mm)	Length (mm)	Weight per pack(kg)	Weight per carton(kg)	Weight per piece(g)
3.2	350	5	20	32
4.0	400	5	20	56
5.0	400	5	20	87

## CM-9

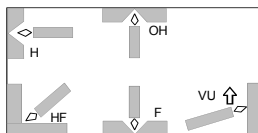
Low hydrogen type covered electrode for 9%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.5 E8016-B8  
JIS Z3223 DT2616

**Feature :** •Suitable for butt and fillet welding  
•Applied for ASTM A387 Gr.9 and equivalents

**Redrying Conditions:** 325~375°Cx1h

Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo
Example	0.08	0.40	0.68	0.007	0.004	9.56	1.03
Guaranty	0.05~ 0.10	≤0.90	≤1.0	≤0.03	≤0.03	8.0~ 10.5	0.85~ 1.20

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	510	680	26	0°C: 110	740x10
Guaranty	≥460	≥550	≥19	-	740±15x1

## Recommended welding parameters

	2.6mm	3.2mm	4.0mm	5.0mm
F	55~85A	75~115A	120~160A	160~220A
VU, OH	50~80A	70~110A	90~150A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	18
3.2	350	5	20	30
4.0	400	5	20	55
5.0	400	5	20	85

## CM-9Cb

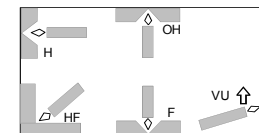
Low hydrogen type covered electrode for 9%Cr-1%Mo-Nb-V heat resistant steel

**Classification:** ASME / AWS A5.5 E9016-G

**Features :** •Suitable for butt and fillet welding  
•Applicable for ASTM A387 Gr.91 and equivalents  
•Excellent creep rupture strength  
•Good performance by AC current

**Redrying Conditions:** 325~375°Cx1h

Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo	Nb	V
Example	0.06	0.31	1.51	0.006	0.003	0.94	9.11	1.06	0.03	0.18
Guaranty	≤0.12	≤0.60	≤2.00	≤0.025	≤0.025	≤1.00	8.00~ 10.50	0.80~ 1.20	≤0.15	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	600	750	25	0°C: 81	750x5
Guaranty	≥530	≥620	≥17	-	740±15x1

## Recommended welding parameters

	2.6mm	3.2mm	4.0mm	5.0mm
F	55~85A	75~115A	120~160A	160~220A
VU, OH	50~80A	70~110A	90~150A	-

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	18
3.2	350	5	20	31
4.0	400	5	20	55
5.0	400	5	20	85

# CM-96B9

Low hydrogen type covered electrode for 9%Cr-1%Mo-Nb-V heat resistant steel

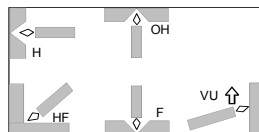
**Classification:** ASME / AWS A5.5 E9016-B9

**Features :**

- Suitable for butt and fillet welding
- Applied for ASTM A387 Gr.91 and equivalents
- Excellent creep rupture strength
- Good performance by DC-EP current

**Redrying Conditions:** 325~375°Cx1h

**Welding Positions:**



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo	Nb	V
Example	0.11	0.20	1.17	0.005	0.001	0.86	9.21	0.99	0.04	0.23
Guaranty	0.08~ 0.13	≤0.30	≤1.25	≤0.01	≤0.01	≤1.0	8.0~ 10.5	0.85~ 1.20	0.02~ 0.10	0.15~ 0.30

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	754	850	20	0°C: 30	740x1
Guaranty	≥530	≥620	≥17	-	740±15x1

## Recommendable welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm
F	55~85A	75~115A	120~160A	160~220A	
VU, OH	50~80A	70~110A	90~150A	-	

## Polarity

Example	DC-EP
Guaranty	DC-EP

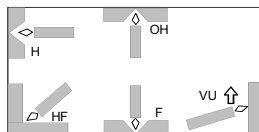
## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	18
3.2	350	5	20	31
4.0	400	5	20	55
5.0	400	5	20	85



## DW-81B2

Rutile type flux cored wire for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.29 E81T1-B2/B2M**Features :** •Suitable for butt and fillet welding in all positions  
•Applicable for ASTM A387 Gr.11, Gr.12 and equivalents**Shielding gas:** CO<sub>2</sub> or 75~85%Ar-Bal. CO<sub>2</sub> mixture**Polarity:** DC-EP**Welding Positions:****Chemical composition of all-weld metal (%) as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.05	0.61	0.60	0.008	0.013	1.29	0.51
Guaranty	0.05~ 0.12	≤0.80	≤1.25	≤0.030	≤0.030	1.00~ 1.50	0.40~ 0.65

**Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.06	0.46	0.46	0.008	0.009	1.23	0.48
Guaranty	0.05~ 0.12	≤0.80	≤1.25	≤0.030	≤0.030	1.00~ 1.50	0.40~ 0.65

**Mechanical properties of all-weld metal as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	PWHT (°C×h)
Example	591	670	24	690x1
Guaranty	≥470	550~690	≥19	690±15x1

**Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	PWHT (°C×h)
Example	549	633	25	690x1
Guaranty	≥470	550~690	≥19	690±15x1

**Recommended welding parameters**

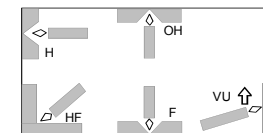
	Dia.	Type	Weight (kg)
Dia.	1.2mm	1.6mm	
HF	230~300A	280~350A	
VU, OH	190~260A	230~300A	

**Packages**

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
1.6	Spool	12.5

## DWA-81B2

Rutile Type flux cored wire for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.29 E81T1-B2M**Features :** •Suitable for butt and fillet welding in all positions  
•Applicable for ASTM A387 Gr.11, Gr.12 and equivalents  
•Higher impact value compared with DW-81B2**Shielding gas:** 75~85%Ar-Bal. CO<sub>2</sub> mixture**Polarity:** DC-EP**Welding positions:****Chemical composition of all-weld metal (%) as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.05	0.55	0.97	0.006	0.012	1.34	0.49
Guaranty	0.05- 0.12	≤0.80	≤1.25	≤0.03	≤0.03	1.00- 1.50	0.40- 0.65

**Mechanical properties of all-weld metal as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	575	655	25	-18°C: 67	690x1
Guaranty	≥470	550-690	≥19	-	690±15x1

**Recommended welding parameters**

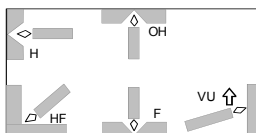
	Dia.	Type	Weight (kg)
Dia.	1.2mm		
HF	220~270A		
VU, OH	200~250A		

**Packages**

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## DW-91B3

Rutile type flux cored wire for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.29 E91T1-B3/B3M**Features :** •Suitable for butt and fillet welding in all position  
•Applied for ASTM A387 Gr.22 and equivalents**Shielding gas:** CO<sub>2</sub> or 75~85%Ar-Bal. CO<sub>2</sub> mixture**Polarity:** DC-EP**Welding positions:****Chemical composition of all-weld metal (%) as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.05	0.62	0.59	0.008	0.010	2.25	0.97
Guaranty	0.05~ 0.12	≤0.80	≤1.25	≤0.030	≤0.030	2.00~ 2.50	0.90~ 1.20

**Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.06	0.47	0.50	0.010	0.009	2.16	0.97
Guaranty	0.05~ 0.12	≤0.80	≤1.25	≤0.030	≤0.030	2.00~ 2.50	0.90~ 1.20

**Mechanical properties of all-weld metal as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	PWHT (°C×h)
Example	633	723	21	690x1
Guaranty	≥540	620~760	≥17	690±15x1

**Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	PWHT (°C×h)
Example	602	690	20	690x1
Guaranty	≥540	620~760	≥17	690±15x1

**Recommended welding parameters**

Dia.	1.2mm	1.6mm
HF	230~300A	280~350A
VU, OH	190~260A	230~300A

**Packages**

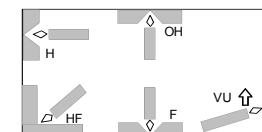
Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
1.6	Spool	12.5

**Approvals**

Others  
CWB

## DWA-91B3

Rutile Type flux cored wire for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.29 E91T1-B3M**Features :** •Suitable for butt and fillet welding in out-of-position  
•Applicable for ASTM A387 Gr.22 and equivalents  
•Higher impact value compared with DW-91B3**Shielding gas:** 75~85%Ar-Bal. CO<sub>2</sub> mixture**Polarity:** DC-EP**Welding positions:****Chemical composition of all-weld metal (%) as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	C	Si	Mn	P	S	Cr	Mo
Example	0.07	0.35	0.85	0.007	0.010	2.29	1.00
Guaranty	0.05- 0.12	≤0.80	≤1.25	≤0.03	≤0.03	2.00- 2.50	0.90- 1.20

**Mechanical properties of all-weld metal as per AWS (Shielding gas: 80%Ar+20%CO<sub>2</sub>)**

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	615	705	21	-18°C: 96	690x1
Guaranty	≥540	620~760	≥17	-	690±15x1

**Recommended welding parameters**

Dia.	1.2mm
HF	220~270A
VU, OH	200~250A

**Packages**

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## TGS-1CM

TIG welding rod and wire for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.28 ER80S-G  
JIS Z3316 YGT1CM

**Features:** •Applicable for ASTM A387 Gr.11, Gr.12 and equivalents

**Shielding Gas:** Ar

**Polarity:** DC-EN

## Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
Example	0.08	0.52	1.10	0.007	0.009	1.40	0.55	0.02	0.11
Guaranty	0.05~ 0.12	≤0.70	0.60~ 1.20	≤0.025	≤0.025	1.00~ 1.50	0.40~ 0.65	≤0.20	≤0.35

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	540	630	28	0°C: 270	690x1
Guaranty	≥470	≥550	≥19	-	620±15x1

## Approvals

AB	LR	NV	BV	NK	Others
MG	MG(ER80S-G)	MG	MG(ER80S-G)	MG(E8016-B2)	KR, TÜV

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
0.8	spool	10	-	-
1.0	spool	10	-	-
1.2	tube	5	1,000	9
	spool	10	-	-
	spool	20	-	-
1.6	tube	5	1,000	16
	spool	10	-	-
	spool	20	-	-
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-1CML

TIG welding rod and wire for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.28 ER80S-G  
JIS Z3316 YGT1CML

**Features :** •Applied for ASTM A387 Gr.11, Gr.12 and equivalents

•Lower carbon content than **TGS-1CM**

**Shielding Gas:** Ar

**Polarity:** DC-EN

## Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
Example	0.03	0.50	1.13	0.005	0.009	1.40	0.49	0.04	0.12
Guaranty	≤0.05	≤0.70	≤1.30	≤0.025	≤0.025	1.00~ 1.50	0.40~ 0.65	≤0.20	≤0.35

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	480	580	31	0°C: 300	620x1
Guaranty	≥470	≥550	≥19	-	AW

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
1.2	spool	10	-	-
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-2CM

TIG welding rod and wire for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.28 ER90S-G  
JIS Z3316 YGT2CM

**Features:** •Applied for ASTM A387 Gr.22 and equivalents

**Shielding Gas:** Ar

**Polarity:** DC-EN

## Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
Example	0.11	0.36	0.75	0.004	0.008	2.29	1.07	0.05	0.12
Guaranty	0.05~ 0.13	≤0.70	0.50~ 1.20	≤0.025	≤0.025	2.00~ 2.50	0.90~ 1.20	≤0.20	≤0.35

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	610	720	28	0°C: 250	690x1
Guaranty	≥540	≥620	≥17	-	690±15x1

## Approvals

AB	NV	BV	Others
MG	MG	MG(ER90S-G)	KR, TÜV

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
0.8	spool	10	-	-
1.0	spool	10	-	-
1.2	spool	10	-	-
	tube	5	1,000	9
1.6	spool	10	-	-
	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-2CML

TIG welding rod and wire for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.28 ER80S-G  
JIS Z3316 YGT2CML

**Features :** •Applied for ASTM A387 Gr.22 and equivalents

•Lower carbon content than **TGS-2CM**

**Shielding Gas:** Ar

**Polarity:** DC-EN

## Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
Example	0.03	0.50	1.14	0.007	0.009	2.33	1.09	0.03	0.12
Guaranty	≤0.05	≤0.70	≤1.30	≤0.025	≤0.025	2.10~ 2.60	0.90~ 1.20	≤0.20	≤0.35

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	520	630	28	0°C: 250	690x1
Guaranty	≥470	≥550	≥19	-	690±15x1

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35

## TGS-2CMH

TIG welding rod and wire for 2.25%Cr-1%Mo-V heat resistant steel

**Features :** •Applicable for ASTM A336 Gr. F22V and equivalents  
•Excellent tensile strength at high temperatures and good creep rupture strength

**Shielding Gas:** Ar**Polarity:** DC-EN

## ■ Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr
Example	0.12	0.16	0.43	0.005	0.008	2.31
Guaranty	0.10~0.13	≤0.70	0.20~0.70	≤0.025	≤0.025	2.00~2.50
	Mo	V	Nb	Ni	Cu	
Example	1.06	0.28	0.037	0.01	0.11	
Guaranty	0.90~1.20	0.20~0.40	0.015~0.040	≤0.20	≤0.35	

## ■ Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°Cx h)
Example	623	730	22	-18°C: 300	705x7
Guaranty	≥420	≥590	≥18	-	705±15x8

## ■ Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
1.2	tube	5	1,000	9
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35

## TGS-9CM

TIG welding rod and wire for 9%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.28 ER80S-B8**Features:** •Applied for ASTM A387 Gr.9 and equivalents**Shielding Gas:** Ar**Polarity:** DC-EN

## ■ Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr
Example	0.07	0.39	0.52	0.006	0.009	8.98
Guaranty	≤0.10	≤0.50	0.40~0.70	≤0.025	≤0.025	8.00~10.5
	Mo	Ni	Cu			
Example	1.00	0.18	0.12			
Guaranty	0.8~1.2	≤0.50	≤0.35			

## ■ Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°Cx h)
Example	410	590	32	0°C: 220	750x2
Guaranty	≥470	≥550	≥17	-	745±15x1

## ■ Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
1.2	spool	20	-	-
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-9Cb

TIG welding rod and wire for 9%Cr-1%Mo-Nb-V heat resistant steel

**Classification:** ASME / AWS A5.28 ER90S-G**Features :** •Applied for ASTM A387 Gr.91 and equivalents  
•Excellent creep rupture strength**Shielding Gas:** Ar**Polarity:** DC-EN

## ■ Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cr
Example	0.08	0.16	1.01	0.006	0.005	9.01
Guaranty	≤0.12	≤0.60	≤1.20	≤0.020	≤0.010	8.00~10.00
	Mo	Ni	Nb	V	Cu	
Example	0.90	0.71	0.04	0.18	0.15	
Guaranty	0.85~1.20	≤0.80	0.02~0.12	0.10~0.35	≤0.35	

## ■ Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	700	780	24	0°C: 240	740x8
Guaranty	≥410	≥620	≥16	-	745±15x1

## ■ Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
0.8	spool	10	-	-
1.0	spool	10	-	-
1.2	spool	10	-	-
1.6	spool	10	-	-
	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35
3.2	tube	5	1,000	63

## TGS-90B9

TIG welding rod and wire for 9%Cr-1%Mo-Nb-V heat resistant steel

**Classification:** ASME / AWS A5.28 ER90S-B9**Features :** •Applied for ASTM A387 Gr.91 and equivalents  
•Excellent creep rupture strength**Shielding Gas:** Ar**Polarity:** DC-EN

## ■ Chemical composition of rod and wire (%) as per AWS

	C	Si	Mn	P	S	Cu
Example	0.12	0.17	1.04	0.007	0.005	0.10
Guaranty	0.07~0.13	0.15~0.30	≤1.25	≤0.010	≤0.010	≤0.20
	Cr	Mo	Ni	V	Al	
Example	9.14	0.91	0.93	0.16	-	
Guaranty	8.00~9.50	0.80~1.10	≤1.00	0.15~0.25	≤0.04	

## ■ Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C x h)
Example	756	851	23	0°C: 172	745x1
Guaranty	≥410	≥620	≥16	-	745±15x1

## ■ Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece(g)
1.2	spool	10	-	-
	spool	20	-	-
1.6	tube	5	1,000	16
2.0	tube	5	1,000	25
2.4	tube	5	1,000	35

# MF-38/US-49

## SAW flux and wire combination for 0.5%Mo heat resistant steel

**Classification** : ASME / AWS A5.23 F8P6-EG-A4  
F8A4-EG-A4

JIS Z3183 S584-H

**Features** : •Suitable for single or multi-pass butt welding of 0.5%Mo steel  
•Good mechanical properties of multi-layer weld metal in the as-welded and PWHT conditions

**Redrying conditions of flux**: 150~350°Cx1h

### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.09	0.03	1.58	0.014	0.013	0.52	0.10
Guaranty	0.07~ 0.12	≤0.05	1.25~ 1.80	≤0.025	≤0.025	0.45~ 0.60	≤0.35

### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.10	0.37	1.35	0.014	0.014	0.53	-
Guaranty	≤0.15	≤0.80	≤1.60	≤0.030	≤0.030	0.40~0.65	≤0.35

### Mechanical properties of weld metal (AC) as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	510	600	29	-51°C: 40	600x3
Guaranty	≥470	550~690	≥20	-51°C≥27	620±15x1

### Polarity

Example	AC
Guaranty	AC

### Approvals

	AB	LR	NV	BV	NK
Single	3YTM	3T,3YM,3YT	Ⅲ YTM	A3YTM	KAW3Y46TMH10

### Packages

Wire		
Dia. (mm)	Type	Weight (kg)
1.6	spool	10,20
2.0	spool	10,20
2.4	coil	25
	spool	10,20
3.2	coil	25,76
4.0	coil	25, 75
4.8	coil	25,75
6.4	coil	25

### Flux

Mesh size	Type	Weight (kg)
12x65	can	25
20x200	can	25
20xD	can	25

## MF-38/US-A4

## SAW flux and wire combination for 0.5%Mo heat resistant steel

**Classification :** ASME / AWS A5.23 F8P6-EA4-A4  
F8A4-EA4-A4

JIS Z3183 S584-H

**Features :** •Suitable for single or multi-pass butt welding of 0.5%Mo steel

•Good mechanical properties in multi-layer welding in the as-welded and PWHT conditions

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.09	0.04	1.59	0.010	0.014	0.52	0.10
Guaranty	0.05~ 0.15	≤0.20	1.20~ 1.70	≤0.025	≤0.025	0.45~ 0.65	≤0.35

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.10	0.39	1.35	0.013	0.013	0.52	0.11
Guaranty	≤0.15	≤0.80	≤1.60	≤0.030	≤0.030	0.40~0.65	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	510	600	29	-51°C: 40	620x1
Guaranty	≥470	550~690	≥20	-51°C≥27	620±15x1

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	12x65	can	25
4.0	coil	25	20x200	can	25
4.8	coil	25	20xD	can	25

## MF-38/US-40

## SAW flux and wire combination for 0.5%Mo heat resistant steel

**Classification :** ASME / AWS A5.23 F8P6-EA3-A3  
F9A6-EA3-A3

JIS Z3183 S624-H1

**Features :** •Suitable for single or multi-pass butt welding of 0.5%Mo steel

•Good mechanical properties in multi-layer welding in the as-welded and PWHT conditions

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.13	0.04	1.80	0.008	0.010	0.52	0.12
Guaranty	0.05~0.17	≤0.20	1.65~2.20	≤0.025	≤0.025	0.45~0.65	≤0.35

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Mo	Cu
Example	0.08	0.34	1.58	0.017	0.009	0.45	0.12
Guaranty	≤0.15	≤0.80	≤2.10	≤0.030	≤0.030	0.40~0.65	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	560	630	29	-51°C: 58	620X1
Guaranty	≥470	550~690	≥20	-51°C≥27	620±15x1

## Polarity

Example	AC
Guaranty	AC

## Approvals

AB	NK
Single	MG
	KAW3Y50MH10

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
2.0	spool	20	12x65	can	25
2.4	coil	25	20x200	can	25
3.2	coil	25,75,150	20xD	can	25
4.0	coil	25,75			
4.8	coil	25,75,150			
6.4	coil	25			



## MF-29A/US-511

SAW flux and wire combination for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.23 F7PZ-EG-B2  
JIS Z3183 S641-1CM

**Features :** •Suitable for multi-pass butt welding of 1~1.25%Cr-0.5%Mo steel  
•AC current is recommended

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.12	0.17	0.61	0.004	0.003	1.48	0.52	0.12
Guaranty	0.05~ 0.14	≤0.35	0.35~ 0.85	≤0.020	≤0.020	1.30~ 1.75	0.40~ 0.65	≤0.30

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.09	0.25	0.78	0.008	0.003	1.32	0.52	0.12
Guaranty	0.05~ 0.15	≤0.80	≤1.20	≤0.030	≤0.030	1.00~ 1.50	0.40~ 0.65	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	440	580	28	20°C: 28	650x20
Guaranty	≥400	480~660	≥22	-	690±15x1

## Polarity

Example	AC
Guaranty	AC

## Approvals

Others
Single TÜV

## Packages

Wire		
Dia. (mm)	Type	Weight (kg)
1.2	spool	10
1.6	spool	20
2.4	coil	25
3.2	coil	25
4.0	coil	25
4.8	coil	25
6.4	coil	25

Flux		
Mesh size	Type	Weight (kg)
48xD	can	25

## PF-200/US-511N

SAW flux and wire combination for 1~1.25%Cr-0.5%Mo heat resistant steel

**Classification:** ASME / AWS A5.23 F8P2-EG-B2  
JIS Z3183 S642-1CM

**Features :** •Suitable for multi-pass butt welding of 1~1.25%Cr-0.5%Mo steel  
•AC current is recommended  
•Excellent notch toughness

**Redrying conditions of flux:** 200~300°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.13	0.11	0.70	0.005	0.002	1.50	0.53	0.14
Guaranty	≤0.15	≤0.30	0.50~ 1.00	≤0.015	≤0.015	1.25~ 1.80	0.40~ 0.65	≤0.25

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.10	0.10	0.74	0.007	0.002	1.43	0.54	0.14
Guaranty	0.05~ 0.15	≤0.80	≤1.20	≤0.030	≤0.030	1.00~ 1.50	0.40~ 0.65	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	450	560	31	-29°C: 120	690x8
Guaranty	≥470	550~690	≥20	-29°C≥27	690±15x1

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire		
Dia. (mm)	Type	Weight (kg)
3.2	coil	25
4.0	coil	25
4.8	coil	25

Flux		
Mesh size	Type	Weight (kg)
10x48	can	20

## MF-29A/US-521

## SAW flux and wire combination for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.23 F8P2-EG-B3  
JIS Z3183 S571-2CM

**Features :** •Suitable for multi-pass butt welding of 2.25%Cr-1%Mo steel  
•AC current is recommended

**Redrying conditions of flux:** 150~350°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.07	0.16	0.61	0.008	0.003	2.52	1.05	0.12
Guaranty	≤0.14	≤0.35	0.30~ 0.85	≤0.025	≤0.025	2.35~ 2.80	0.90~ 1.20	≤0.30

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.09	0.17	0.79	0.011	0.002	2.38	1.02	0.12
Guaranty	0.05~ 0.15	≤0.80	≤1.20	≤0.030	≤0.030	2.00~ 2.50	0.90~ 1.20	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	480	600	24	-29°C: 68	690x10
Guaranty	≥470	550~690	≥20	-29°C ≥27	690±15x1

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
1.6	spool	20	48xD	can	25
2.4	coil	25			
3.2	coil	25			
4.0	coil	25			
4.8	coil	25			

## PF-200/US-521S

## SAW flux and wire combination for 2.25%Cr-1%Mo heat resistant steel

**Classification:** ASME / AWS A5.23 F9P2-EG-B3  
JIS Z3183 S642-2CM

**Features :** •Suitable for multi-pass butt welding of 2.25%Cr-1%Mo steel  
•AC current is recommended  
•Excellent notch toughness

**Redrying conditions of flux:** 200~300°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.16	0.14	1.00	0.005	0.002	2.45	1.05	0.12
Guaranty	0.08~ 0.18	≤0.25	0.80~ 1.20	≤0.012	≤0.012	2.20~ 2.70	0.90~ 1.20	≤0.30

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S	Cr	Mo	Cu
Example	0.12	0.10	0.82	0.008	0.001	2.34	1.04	0.12
Guaranty	0.05~ 0.15	≤0.80	≤1.20	≤0.030	≤0.030	2.00~ 2.50	0.90~ 1.20	≤0.35

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	470	610	27	-29°C: 150	690x8
Guaranty	≥540	620~760	≥17	-29°C ≥27	690±15x1

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
3.2	coil	25	10x48	can	20
4.0	coil	25			
4.8	coil	25			

## PF-500 / US-521H

## SAW flux and wire combination for 2.25%Cr-1%Mo-V heat resistant steel

**Features :** •Suitable for multi-pass butt welding of ASTM A336 Gr. F22V and equivalents  
•AC current is recommended  
•Excellent tensile strength at high temperatures and good creep rupture strength

**Redrying conditions of flux:** 200~300°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S
Example	0.13	0.20	1.27	0.004	0.002
Guaranty	≤0.18	≤0.25	0.30~1.40	≤0.025	≤0.025
	Cr	Mo	V	Nb	Cu
Example	2.55	0.98	0.39	0.02	0.12
Guaranty	2.00~2.65	0.90~1.20	0.25~0.45	0.010~0.040	≤0.30

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.08	0.13	1.16	0.006	0.001
Guaranty	0.05~0.15	0.05~0.35	0.50~1.30	≤0.015	≤0.015
	Cr	Mo	V	Nb	
Example	2.53	1.03	0.35	0.015	
Guaranty	2.00~2.60	0.90~1.20	0.20~0.40	0.010~0.040	

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C/h)
Example	620	710	26	-18°C:150	705x7
Guaranty	≥420	590~760	≥16	-	705±15x8

## Polarity

Example	AC
Guaranty	AC

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
4.0	coil	25	10x48	can	20

## PF-500D / US-521HD

## SAW flux and wire combination for 2.25%Cr-1%Mo-V heat resistant steel

**Features :** •Suitable for multi-pass butt welding  
•Applicable for ASTM A336 Gr F22V and equivalents  
•Excellent tensile strength at high temperatures and good creep rupture strength by DC-EP current

**Redrying conditions of flux:** 200~300°Cx1h

## Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S
Example	0.16	0.21	1.30	0.003	0.001
Guaranty	≤0.18	≤0.25	0.30-1.40	≤0.025	≤0.025
	Cr	Mo	V	Nb	Cu
Example	2.54	1.03	0.38	0.022	0.11
Guaranty	2.00-2.65	0.90-1.20	0.25-0.45	0.010-0.040	≤0.30

## Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.07	0.17	1.26	0.007	0.001
Guaranty	0.05-0.15	0.05-0.35	0.50-1.30	≤0.015	≤0.015
	Cr	Mo	V	Nb	Cu
Example	2.44	1.03	0.34	0.011	0.10
Guaranty	2.00-2.60	0.90-1.20	0.20-0.40	0.010-0.040	-

## Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C/h)
Example	518	634	26	-30°C:106	*1
Guaranty	≥420	≥590	≥18	-	705±15x8

\*1: 705°Cx 8h for impact test, 705°Cx 26h for tensile test

## Polarity

Example	DC-EP
Guaranty	DC-EP

## Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
4.0	coil	25	10x48	can	20

# PF-200S/US-9Cb

## SAW flux and wire combination for 9%Cr-1%Mo-Nb-V heat resistant steel

**Classification:** ASME / AWS A5.23 F10PZ-EG-G

**Features :** •Suitable for multi-pass butt welding of 9%Cr-1%Mo-Nb-V steel

•AC current is recommended

•Excellent creep rupture strength

**Redrying conditions of flux:** 200~300°Cx1h

### Chemical composition of wire (%) as per AWS

	C	Si	Mn	P	S
Example	0.08	0.13	1.73	0.007	0.005
Guaranty	≤0.14	≤0.30	≤2.00	≤0.020	≤0.020
	Cr	Mo	Nb	V	Ni
Example	8.91	0.90	0.05	0.23	0.60
Guaranty	8.00~10.50	0.80~1.20	≤0.10	≤0.50	≤1.00

### Chemical composition of weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.06	0.12	1.58	0.008	0.004
Guaranty	≤0.12	≤0.60	≤2.00	≤0.025	≤0.025
	Cr	Mo	Nb	V	Ni
Example	8.31	0.88	0.03	0.21	0.55
Guaranty	8.00~10.50	0.80~1.20	≤0.15	≤0.50	≤1.00

### Mechanical properties of weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)	PWHT (°C×h)
Example	580	710	24	0°C: 68	740x8
Guaranty	≥610	690~830	≥16	-	745±15x1

### Polarity

Example	AC
Guaranty	AC

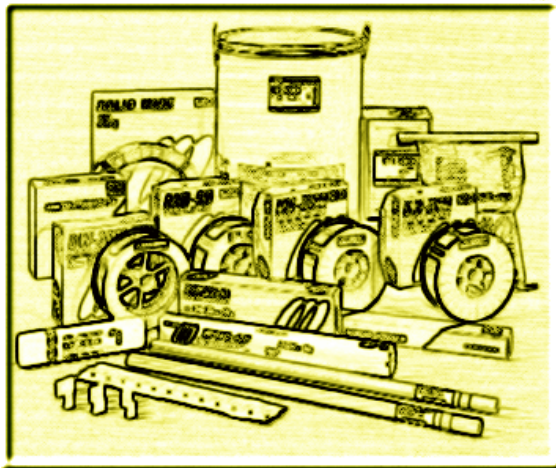
### Packages

Wire			Flux		
Dia. (mm)	Type	Weight (kg)	Mesh size	Type	Weight (kg)
1.6	spool	20			
2.4	coil	25	10x48	can	20
3.2	coil	25			
4.0	coil	25			



Use the bookmark or click ☐  
the list mark below for details

For Stainless Steel



■ A guide for selecting  
welding consumables

**Welding consumables and  
proper welding conditions for**

- Shielded Metal Arc Welding (SMAW)
- Flux Cored Arc Welding (FCAW)
- Gas Tungsten Arc Welding GTAW)

## For Stainless Steel

### A guide for selecting welding consumables

Steel type	Key note for application	SMAW	FCAW	GMAW	GTAW	SAW
304	•General	NC-38	DW-308 DW-308LP	MGS-308	TGS-308	PFS-1 / US-308
304L	•Cryogenic temperatures	NC-38LT	DW-308LT		TGS-308L	PFS-1LT / US-308L
	•Low carbon 0.04% max.	NC-38L	DW-308L DW-308LP	MGS-308LS	TGS-308L TGX-308L	PFS-1 / US308L
	•High temperature PWHT and solution treatment	NC-38, NC-38L	DW-308LH			
304H	•High temperatures	NC-38H	DW-308H			
304N2	•General		DW-308N2			
-	•Dissimilar-metal joints	NC-39 NC-39L NC-39MoL	DW-309 DW-309L DW-309MoL DW-309LP DW-309MoLP	MGS-309 MGS-309LS	TGS-309 TGS-309L TGX-309L	PFS-1 / US-309 PFS-1 / US-309L
	•High temperature PWHT and solution treatment		DW-309LH			
316	•General	NC-36	DW-316 DW-316LP		TGS-316	PFS-1M / US-316
316L	•Cryogenic temperatures	NC-36LT	DW-316LT		TGS-316L	
	•Low carbon 0.04% max.	NC-36L	DW-316L DW-316LP	MGS-316LS	TGS-316L TGX-316L	PFS-1M / US-316L
	•High temperature PWHT and solution treatment	NC-36, NC-36L	DW-316LH			
316LN	•Low carbon 0.04% max.		DW-317L			
316H	•High temperatures		DW-316H			
-	•Urea	NC-316MF			N04051 TGS-310MF	
317L	•Low carbon 0.04% max.	NC-317L	DW-317L		TGS-317L	PFS-1 / US-317L
347	•General	NC-37	DW-347		TGS-347 TGX-347	PFS-1 / US-347
	•Low carbon	NC-37L		MGS-347S		
	•High temperatures	NC-37	DW-347H			
321	•General	NC-37	DW-347			
	•High temperatures		DW-347H			
310S	•General	NC-30	DW-310		TGS-310	
312	•General	NC-32	DW-312			
-	•Duplex stainless	NC-329M	DW-329A DW-329AP		TGS-329E	
410	•General	CR-40		MGS-410	TGS-410	PFS-4M / US-410
405	•Overlaying in cladding	CR-40Cb	DW-410Cb		TGS-410Cb	
	•Underlaying in cladding	CR-43Cb CR-43CbS	DW-430CbS			
-	•Low carbon martensite		MXA-135N MXA-410NM			
430	•General	CR-43				
409	•Car exhaust system		MXA-430M	MGS-430M		
410L	•Car exhaust system		MXA-430M	MGS-430M		

## NC-38

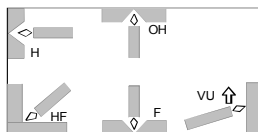
## Lime titania type covered electrode for 18%Cr-8%Ni stainless steel

**Classification:** ASME / AWS A5.4 E308-16  
JIS Z3221 D308-16

**Features :** •Applicable for 304 type steel  
•Suitable for butt and fillet welding

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr
Example	0.07	0.35	1.69	0.023	0.002	9.58	20.49
Guaranty	≤0.08	≤0.90	0.5~2.5	≤0.04	≤0.03	9.0~11.0	18.0~21.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	600	46	0°C: 74
Guaranty	-	≥550	≥35	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	NV	NK
MG(E308-16)	308	KD308

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	250	2	20	11
2.6	300	2	20	20
3.2	350	5	20	36
4.0	350	5	20	54
5.0	350	5	20	80

## NC-38L

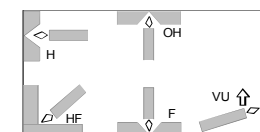
## Lime titania type covered electrode for low carbon 18%Cr -8%Ni stainless steel

**Classification:** ASME / AWS A5.4 E308L-16  
JIS Z3221 D308L-16

**Features :** •Applicable for 304L type steel  
•Suitable for butt and fillet welding  
•Lower carbon content than NC-38

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr
Example	0.034	0.33	1.43	0.022	0.006	9.57	20.07
Guaranty	≤0.04	≤0.90	0.5~2.5	≤0.04	≤0.03	9.0~11.0	18.0~21.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	580	48	0°C: 78
Guaranty	-	≥520	≥35	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

LR	NK
304L m(Chem.)	KD308L

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	250	2	20	9
2.6	300	2	20	18
3.2	350	5	20	33
4.0	350	5	20	51
5.0	350	5	20	79

## NC-39

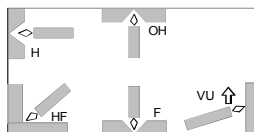
## Lime titania type covered electrode for 22%Cr-12%Ni stainless steel and dissimilar metals

**Classification:** ASME / AWS A5.4 E309-16  
JIS Z3221 D309-16

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels in stainless steel weld metal overlaying

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr
Example	0.08	0.53	1.50	0.020	0.003	12.72	23.97
Guaranty	≤0.15	≤0.90	0.5~2.5	≤0.04	≤0.03	12.0~14.0	22.0~25.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	590	39	0°C: 62
Guaranty	-	≥ 550	≥ 30	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	BV	NK	Others
MG(E309-16)	SS/CMn m(Chem.)	309, MG	MG(E309-16)	KD309	CCS

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	250	2	20	9
2.6	300	2	20	20
3.2	350	5	20	35
4.0	350	5	20	51
5.0	350	5	20	78

## NC-39L

## Lime titania type covered electrode for dissimilar metals

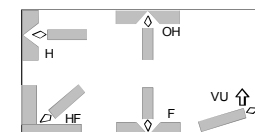
**Classification:** ASME / AWS A5.4 E309L-16  
JIS Z3221 D309L-16

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels in stainless steel weld metal overlaying

•Lower carbon content than **NC-39**

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr
Example	0.030	0.60	1.50	0.020	0.005	12.50	23.13
Guaranty	≤0.04	≤0.90	0.5~2.5	≤0.04	≤0.03	12.0~14.0	22.0~25.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	560	42	0°C: 67
Guaranty	-	≥ 520	≥ 30	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

NV	BV	NK	Others
309L, MG	MG(E309L-16)	KD309L	TÜV

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.6	300	2	20	19
3.2	350	5	20	34
4.0	350	5	20	55
5.0	350	5	20	85



## NC-39MoL

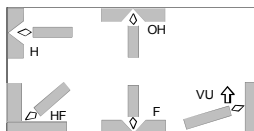
## Lime titania type covered electrode for dissimilar metals

**Classification:** ASME / AWS A5.4 E309MoL-16  
JIS Z3221 D309MoL-16

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels in stainless steel weld metal overlaying  
•Lower carbon content than **NC-39**

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo
Example	0.029	0.51	1.28	0.024	0.005	12.65	23.08	2.29
Guaranty	≤0.04	≤0.90	0.5~2.5	≤0.04	≤0.03	12.0~14.0	22.0~25.0	2.0~3.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	450	630	41	0°C: 65
Guaranty	-	≥520	≥30	-

## Recommended welding parameters

	Dia.	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	50~85A	70~115A	95~145A	135~180A	
VU, OH	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	NK
MG	KD309Mo

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece(g)
2.6	300	2	20	19
3.2	350	5	20	33
4.0	350	5	20	54
5.0	350	5	20	85

## NC-36

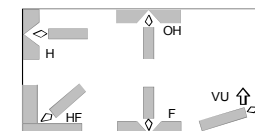
## Lime titania type covered electrode for 18%Cr-12%Ni-2%Mo stainless steel

**Classification:** ASME / AWS A5.4 E316-16  
JIS Z3221 D316-16

**Features :** •Applicable for 316 type steel  
•Suitable for butt and fillet welding

**Redrying Conditions:** 150~200°Cx0.5~1h

## Welding Positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo
Example	0.06	0.32	1.33	0.022	0.004	11.79	19.17	2.25
Guaranty	≤0.08	≤0.90	0.5~2.5	≤0.04	≤0.03	11.0~14.0	17.0~20.0	2.0~3.0

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	410	570	46	0°C: 80
Guaranty	-	≥520	≥30	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

NK
KD316

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	250	2	20	10
2.6	300	2	20	19
3.2	350	5	20	33
4.0	350	5	20	51
5.0	350	5	20	78

# NC-36L

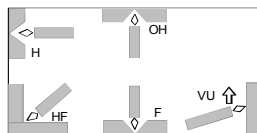
Lime titania type covered electrode for low carbon 18%Cr-12%Ni-2%Mo stainless steel

**Classification :** ASME / AWS A5.4 E316L-16  
JIS Z3221 D316L-16

**Features :** •Applicable for 316L type steel  
•Suitable for butt and fillet welding  
•Lower carbon content than **NC-36**

**Redrying Conditions:** 150~200°Cx0.5~1h

**Welding Positions:**



## Chemical composition of all-weld metal (%) / as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo
Example	0.023	0.57	1.56	0.025	0.003	12.17	18.68	2.20
Guaranty	≤0.04	≤0.90	0.5~2.5	≤0.04	≤0.03	11.0~14.0	17.0~20.0	2.0~3.0

## Mechanical properties of all-weld metal / as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	420	580	45	0°C: 83
Guaranty	-	≥485	≥30	-

## Recommended welding parameters

	Dia.	2.0mm	2.6mm	3.2mm	4.0mm	5.0mm
F, HF, H	25~55A	50~85A	70~115A	95~145A	135~180A	
VU, OH	20~50A	45~80A	65~110A	85~135A	-	

## Polarity

Example	AC
Guaranty	AC, DC-EP

## Approvals

AB	LR	NV	BV	NK
MG(E316-16)	316L m(Chem.)	316L, MG	MG(E316-16)	KD316L

## Packages

Dia. (mm)	Length (mm)	Weight per pack (kg)	Weight per carton (kg)	Weight per piece (g)
2.0	250	2	20	10
2.6	300	2	20	19
3.2	350	5	20	34
4.0	350	5	20	51
5.0	350	5	20	78

## DW-308

## Rutile type flux cored wire for 18%Cr-8%Ni stainless steel

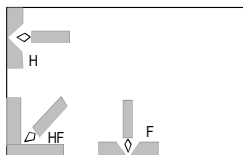
**Classification:** ASME / AWS A5.22 E308T0-1 / 4  
EN 12073 T Z 19 9 R C/M 3  
JIS Z3323 YF308C

**Features :** •Applicable for 304 type steel  
•Suitable for flat and horizontal fillet welding

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.050	0.57	1.52	0.020	0.009	9.68	19.72	0.02	0.03
Guaranty	≤0.08	≤1.00	0.50~ 2.50	≤0.040	≤0.030	9.00~ 11.00	18.00~ 21.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	390	570	41	0°C: 39
Guaranty	-	≥550	≥35	-

## Recommended welding parameters

	Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A	
H	90~130A	150~220A	220~270A	

## Approvals

NK	Others
KW308G(C)	CWB

## Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	5, 12.5
1.2	Spool	12.5
1.6	Spool	12.5

## DW-308L

## Rutile type flux cored wire for low carbon 18%Cr-8%Ni stainless steel

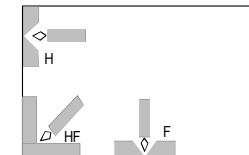
**Classification:** ASME / AWS A5.22 E308LT0-1/4  
EN 12073 T 19 9 L R C/M 3  
JIS Z3323 YF308LC

**Features:** •Applied for 304L type steel  
•Suitable for flat and horizontal fillet welding  
•Lower carbon content than DW-308

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.027	0.56	1.49	0.019	0.008	10.02	19.53	0.02	0.03
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	9.00~ 11.00	18.00~ 21.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	370	550	42	0°C: 41
Guaranty	-	≥520	≥35	-

## Recommended welding parameters

	Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A	
H	90~130A	150~220A	220~270A	

## Approvals

AB	LR	NV	NK	Others
MG	304L S (Chem. Cryo.)	308LMS	KW308LG(C)	CWB, TÜV

## Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	5, 12.5
1.2	Spool	12.5
1.6	Spool	12.5

## DW-308LP

## Rutile type flux cored wire for low carbon 18%Cr-8%Ni stainless steel

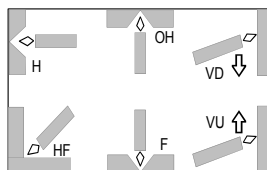
**Classification:** ASME / AWS A5.22 E308LT-1/4  
EN 12073 T 19 9 L P C/M 1  
JIS Z3323 YF308LC

**Features:** •Applicable for 304 and 304L type steel  
•Suitable for butt and fillet welding in all positions including vertical downward  
•Lower carbon content than **DW-308**

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.027	0.55	1.51	0.022	0.010	9.89	19.45	0.02	0.03
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	9.00~ 11.00	18.00~ 21.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	380	550	45	0°C: 57
Guaranty	-	≥520	≥35	-

## Recommended welding parameters

Dia.		1.2mm	
F, HF	130~270A	OH	150~200A
H	150~220A	VD	150~200A
VU	130~220A		

VD position: multi-pass welding is not recommended.

## Approvals

AB	LR	NK	Others
MG	304LMS (Chem. Cryo.)	KW308LG (C)	KR, CWB

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## DW-309

## Rutile type flux cored wire for dissimilar metals

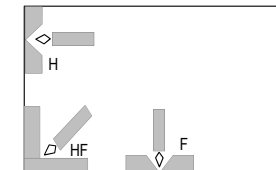
**Classification:** ASME / AWS A5.22 E309T0-1/4  
EN 12073 T Z 23 12 R C/M 3  
JIS A3323 YF309C

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels for overlaying stainless steel weld metals

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.035	0.58	1.22	0.021	0.009	12.48	24.03	0.03	0.02
Guaranty	≤0.10	≤1.00	0.50~ 2.50	≤0.040	≤0.030	12.00~ 14.00	22.00~ 25.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	450	590	32	0°C: 33
Guaranty	-	≥550	≥30	-

## Recommended welding parameters

Dia.	1.2mm	1.6mm
F, HF	130~270A	190~340A
H	150~220A	220~270A

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
1.6	Spool	12.5

## DW-309L

## Rutile type flux cored wire for dissimilar metals

**Classification:** ASME / AWS A5.22 E309LT0-1/4  
EN 12073 T 23 12 L R C/M 3  
JIS Z3323 YF309LC

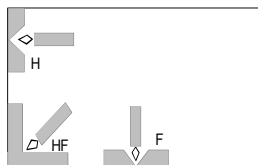
**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels for overlaying stainless steel weld metals

•Lower carbon content than DW-309

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.028	0.61	1.24	0.019	0.010	12.58	24.17	0.05	0.03
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	12.00~ 14.00	22.00~ 25.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)
Example	450	580	33
Guaranty	-	≥520	≥30

## Recommended welding parameters

	Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A	
H	90~130A	150~220A	220~270A	

## Approvals

AB	LR	NV	BV	NK	Others
MG	SS/CMn S (Chem.)	309LMS	MG	KW309LG(C) (base on KW309)	CWB

## Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	5, 12.5
1.2	Spool	12.5
1.6	Spool	12.5

## DW-309LP

## Rutile type flux cored wire for dissimilar metals

**Classification:** ASME / AWS A5.22 E309LT1-1/4  
EN 12073 T 23 12 L P C/M 1  
JIS Z3323 YF309LC

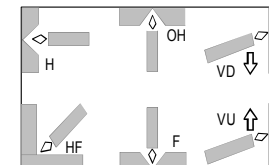
**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels for overlaying stainless steel weld metals

•Lower carbon content than DW-309

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.027	0.56	1.21	0.023	0.009	12.45	23.55	0.04	0.06
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	12.00~ 14.00	22.00~ 25.00	≤0.50	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)
Example	430	570	38
Guaranty	-	≥520	≥30

## Recommended welding parameters

	Dia.	1.2mm	Dia.	1.2mm
F, HF	130~270A	OH	150~200A	
H	150~220A	VD	150~200A	
VU	130~220A			

VD position: multi-pass welding is not recommended.

## Approvals

LR	NV	NK	Others
SS/CMn MS (Chem.,Cryo)	309L	KW309LG(C)	CWB

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## DW-309MoL

## Rutile type flux cored wire for dissimilar metals

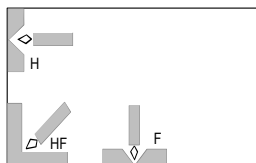
**Classification:** ASME / AWS A5.22 E309LMoT0-1/4  
EN 12073 T 23 12 2 L R C/M 3  
JIS Z3323 YF309MoLC

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels for overlaying stainless steel weld metals

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.027	0.61	1.18	0.019	0.009	12.60	23.20	2.37	0.03
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	12.00~ 14.00	22.00~ 25.00	2.00~ 3.00	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	EI (%)
Example	540	720	30
Guaranty	-	≥520	≥25

## Recommended welding parameters

Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A
H	90~130A	150~220A	220~270A

## Approvals

AB	LR	NV	BV	NK	Others
MG	SS/CMn S (Chem.)	309MoLMS	MG	MG	TÜV

## Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	5, 12.5
1.2	Spool	12.5
1.6	Spool	12.5

## DW-309MoLP

## Rutile type flux cored wire for dissimilar metals

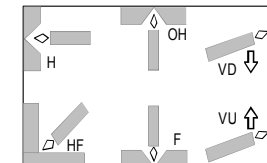
**Classification:** ASME / AWS A5.22 E309LMoT1-1/4  
EN 12073 T 23 12 2 L P C/M 1  
JIS Z3323 YF309MoLC

**Features :** •Suitable for dissimilar-metal joint and underlaying on ferritic steels for overlaying stainless steel weld metals

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.025	0.62	0.81	0.020	0.010	12.44	22.60	2.21	0.05
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	12.00~ 14.00	22.00~ 25.00	2.00~ 3.00	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	EI (%)
Example	540	699	30
Guaranty	-	≥520	≥25

## Recommended welding parameters

Dia.	1.2mm	Dia.	1.2mm
F, HF	130~270A	OH	150~200A
H	150~220A	VD	150~200A
VU	130~220A		

VD position: multi-pass welding is not recommended

## Approvals

LR	NV	BV
SS/CMn S (Chem.)	309MoLMS	MG

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## DW-316

## Rutile type flux cored wire for 18%Cr-12%Ni-2%Mo stainless steel

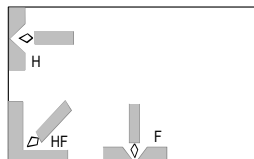
**Classification:** ASME / AWS A5.22 E316T0-1/4  
EN 12073 T Z 19 12 2 R C/M 3  
JIS Z3323 YF316C

**Features :** •Applicable for 316 type steel  
•Suitable for flat and horizontal fillet welding

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.043	0.59	1.50	0.021	0.010	12.04	19.30	2.31	0.03
Guaranty	≤0.080	≤1.00	0.50~ 2.50	≤0.040	≤0.030	11.00~ 14.00	17.00~ 20.00	2.00~ 3.00	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	390	555	40	0°C: 42
Guaranty	-	≥550	≥30	-

## Recommended welding parameters

	Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A	
H	90~130A	150~220A	220~270A	

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
1.6	Spool	12.5

## DW-316L

## Rutile type flux cored wire for low carbon 18%Cr-12%Ni-2%Mo stainless steel

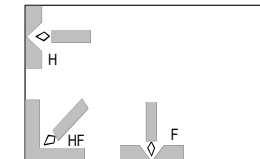
**Classification:** ASME / AWS A5.22 E316LT0-1/4  
EN 12073 T 19 12 3 L R C/M 3  
JIS Z3323 YF316LC

**Features :** •Applicable for 316L type steel  
•Suitable for flat and horizontal fillet welding  
•Lower carbon content than DW-316

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.026	0.59	1.43	0.020	0.010	12.02	18.95	2.54	0.06
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	11.00~ 14.00	17.00~ 20.00	2.00~ 3.00	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	380	540	41	0°C: 44
Guaranty	-	≥485	≥30	-

## Recommended welding parameters

	Dia.	0.9mm	1.2mm	1.6mm
F, HF	80~150A	130~270A	190~340A	
H	90~130A	150~220A	220~270A	

## Approvals

AB	LR	NV	BV	NK	Others
MG	316L S (Chem.)	316LMS	MG	KW316LG(C)	CWB,TÜV

## Packages

Dia. (mm)	Type	Weight (kg)
0.9	Spool	5, 12.5
1.2	Spool	12.5
1.6	Spool	12.5

## DW-316LP

## Rutile type flux cored wire for low carbon 18%Cr-12%Ni-2%Mo stainless steel

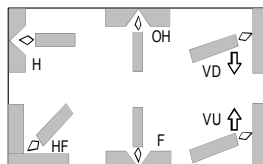
**Classification:** ASME / AWS A5.22 E316LT-1/4  
EN 12073 T 19 12 3 L P C/M 1  
JIS Z3323 YF316LC

**Features :** •Applicable for 316 and 316L type steel  
•Suitable for butt and fillet welding in all positions including vertical downward  
•Lower carbon content than DW-316

**Shielding gas :** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo
Example	0.028	0.60	1.50	0.021	0.008	12.65	18.35	2.68
Guaranty	≤0.040	≤1.00	0.50~ 2.50	≤0.040	≤0.030	11.00~ 14.00	17.00~ 20.00	2.00~ 3.00

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	370	540	43	0°C: 54
Guaranty	-	≥485	≥30	-

## Recommended welding parameters

Dia.		1.2mm	
F, HF	130~270A	OH	150~200A
H	150~220A	VD	150~200A
VU	130~220A		

VD position: multi-pass welding is not recommendable.

## Approvals

NV	NK	Others
316L	KW316LG(C)	CWB

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## DW-329A

## Rutile type flux cored wire for duplex stainless steel

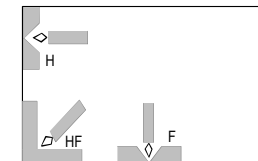
**Classification:** ASME / AWS A5.22 E2209T0-1/4  
EN 12073 T 22 9 3 N L R C/M 3

**Features :** •Applied for SUS329J3L and ASTM S31803 steel  
•Suitable for flat and horizontal fillet welding

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	N	Cu
Example	0.030	0.58	1.12	0.018	0.008	9.34	22.91	3.08	0.12	0.01
Guaranty	≤0.040	≤1.00	0.50~ 2.00	≤0.040	≤0.030	8.00~ 10.00	22.00~ 24.00	2.50~ 4.00	0.08~ 0.20	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	610	810	29	-20°C: 42
Guaranty	-	≥690	≥20	-

## Recommended welding parameters

	Dia.	1.2mm	1.6mm
F, HF		130~250A	200~300A
H		150~220A	220~250A

## Approvals

Others

TÜV

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5
1.6	Spool	12.5



## DW-329AP

## Rutile type flux cored wire for duplex stainless steel

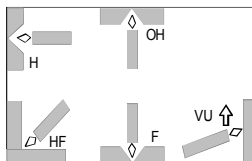
**Classification:** ASME / AWS A5.22 E2209T1-1/4  
EN 12073 T 22 9 3 N L P C/M 1

**Features :** •Applicable for SUS329J3L and ASTM S31803 steel  
•Suitable for butt and fillet welding in all positions

**Shielding gas:** CO<sub>2</sub> or Ar-CO<sub>2</sub> mixture

**Polarity:** DC-EP

## Welding positions:

Chemical composition of all-weld metal (%) as per AWS (Shielding gas: CO<sub>2</sub>)

	C	Si	Mn	P	S	Ni	Cr	Mo	N	Cu
Example	0.027	0.58	0.78	0.019	0.008	9.42	23.34	3.42	0.14	0.02
Guaranty	≤0.040	≤1.00	0.50~ 2.00	≤0.025	≤0.020	8.00~ 10.00	22.00~ 24.00	2.50~ 4.00	0.08~ 0.20	≤0.50

Mechanical properties of all-weld metal as per AWS (Shielding gas: CO<sub>2</sub>)

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	620	830	29	-20°C: 45
Guaranty	≥500	≥700	≥20	-

## Recommended welding parameters

Dia.	1.2mm
F, HF	130~250A
H	150~220A
VU	130~220A
OH	160~190A

## Approvals

Others

CWB

## Packages

Dia. (mm)	Type	Weight (kg)
1.2	Spool	12.5

## T6X-308L

## Flux cored filler rod for low carbon 18%Cr-8%Ni stainless steel

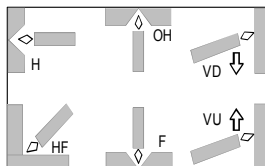
**Classification:** ASME / AWS A5.22 R308LT1-5

**Features :** •Applicable for 304 and 304L type steels  
•Suitable for root pass in one-side TIG welding without back shielding

**Shielding gas:** Ar

**Polarity:** DC-EN

## Welding positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.018	0.80	1.66	0.023	0.005	10.31	19.62	0.02	0.03
Guaranty	≤0.03	≤1.20	0.50~2.50	≤0.040	≤0.030	9.00~11.00	18.00~21.00	≤0.50	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	450	620	47	-196°C: 60
Guaranty	-	≥520	≥35	-

## Recommended welding parameters

Plate thickness	Welding current
3~5mm	80~90A
6~9mm	90~105A
≥10mm	90~110A

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
2.2	tube	5	1,000	25

## T6X-309L

## Flux cored filler rod for dissimilar metals

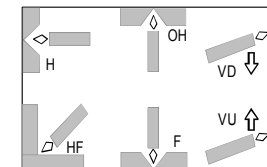
**Classification:** ASME / AWS A5.22 R309LT1-5

**Features :** •Suitable for root pass in one-side TIG welding without back shielding  
•Applicable for dissimilar-metal joint of austenitic stainless steels and ferritic steels

**Shielding gas:** Ar

**Polarity:** DC-EN

## Welding positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.017	0.81	1.52	0.022	0.006	12.62	24.26	0.02	0.03
Guaranty	≤0.03	≤1.20	0.50~2.50	≤0.040	≤0.030	12.00~14.00	22.00~25.00	≤0.50	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)
Example	530	680	32
Guaranty	-	≥520	≥30

## Recommended welding parameters

Plate thickness	Welding current
3~5mm	80~90A
6~9mm	90~105A
≥10mm	90~110A

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
2.2	tube	5	1,000	25

## TGX-316L

## Flux cored filler rod for low carbon 18%Cr-12%Ni-2%Mo stainless steel

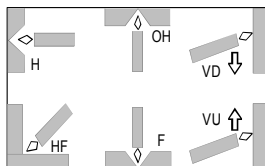
**Classification:** ASME / AWS A5.22 R316LT1-5

**Features :** •Applicable for 316 and 316L type steels  
•Suitable for root pass in one-side TIG welding without back shielding

**Shielding gas:** Ar

**Polarity:** DC-EN

## Welding positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
Example	0.016	0.87	1.55	0.023	0.004	12.47	18.89	2.32	0.03
Guaranty	≤0.03	≤1.20	0.50~2.50	≤0.040	≤0.030	11.00~14.00	17.00~20.00	2.00~3.00	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	440	600	38	0°C: 110
Guaranty	-	≥485	≥30	-

## Recommended welding parameters

## Plate thickness Welding current

3~5mm	80~90A
6~9mm	90~105A
≥10mm	90~110A

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
2.2	tube	5	1,000	25

## TGX-347

## Flux cored filler rod for 18%Cr-8%Ni-Nb and 18%Cr-8Ni-Ti stainless steel

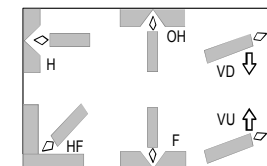
**Classification:** ASME / AWS A5.22 R347T1-5

**Features :** •Applicable for 347 and 321 type steels  
•Suitable for root pass in one-side TIG welding without back shielding

**Shielding gas:** Ar

**Polarity:** DC-EN

## Welding positions:



## Chemical composition of all-weld metal (%) as per AWS

	C	Si	Mn	P	S
Example	0.020	0.80	1.60	0.021	0.004
Guaranty	≤0.08	≤1.20	0.50~2.50	≤0.040	≤0.030
	Ni	Cr	Nb+Ta	Mo	Cu
Example	10.21	19.09	0.66	0.02	0.03
Guaranty	9.00~11.00	18.00~21.00	8xC%~1.0	≤0.50	≤0.50

## Mechanical properties of all-weld metal as per AWS

	0.2%OS (MPa)	TS (MPa)	El (%)	IV (J)
Example	460	630	48	0°C: 130
Guaranty	-	≥520	≥30	-

## Recommended welding parameters

Plate thickness	Welding current
3~5mm	80~90A
6~9mm	90~105A
≥10mm	90~110A

## Packages

Dia. (mm)	Type	Weight (kg)	Length (mm)	Weight per piece (g)
2.2	tube	5	1,000	25