



COMPANY PROFILE

CALCUTTA ELECTRODES PVT. LTD.

Commenced manufacturing operation at Raipur in 1994. Presently, a wide range of electrodes ranging from general purpose mild steel, stainless steel, cast iron, non ferrous, hard surfacing, low hydrogen, cutting & gouging electrodes are manufactured at latest technology plant and machinery, latest quality control equipments under strict quality control and confirming to applicable specifications laid down by Bureau of Indian Standards, American Welding Society, British Standard, DIN and JIS Standard. Our R & D centre is well equipped with latest equipments for carrying out all mandatory tests. The company is dedicated to supply of products, services and solutions that meet and exceed the need of end users. Various electrodes are approved by national and international agencies such as BIS, BHEL, IBR, IRS, B V, RDSO, B.S.P., D.M.R.C. Ltd. and Thermex Ltd. etc.

SHIVA SA series, low heat input electrodes for repair and maintenance applications complete the range of stick electrodes. The company also manufactures SHIVA MIG Wire for CO₂ / MIG Welding process, stainless steel wires for GTAW (TIG) and GMAW (MIG) processes.

The regional depots and offices facilitate smooth and quick distribution. A team of qualified and well trained service engineers extends technical services to consumers.

We are an ISO 9001:2008 certified company.





QUALITY POLICY

“We at **CALCUTTA ELECTRODES PVT. LTD.** Commit ourselves to meet the requirement of our customers by supplying them quality products at competitive price & backed by superior after sale service.

We also commit to make continual improvements in Technology, Manufacturing Processes and Services to enhance customer satisfaction & make **CALCUTTA ELECTRODES PVT. LTD.** a Quality Organization.”
We shall achieve this policy by establishing

ISO 9001:2008 QMS



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DESCRIPTION OF ELECTRODES

PIPE WELDING ELECTRODES

SHIVA - 6010

Classification : AWS A 5.1 : E-6010, IS : EC 4410 X

A medium coated, all position cellulosic coated deep penetrating electrode. Forceful and spray type arc suitable for deep penetration and sound welding jobs. Mechanically sound weld metal of radiographic quality. Suitable for welding of pipes and pipelines in all positions using 'stove pipe' and conventional techniques particularly for root bead. Typical application include welding of pipes, tubes, ducts, storage tanks etc. specially suited for pressure pipelines which can not be welded from inside.

Weld Metal Properties

C%	:	0.14 max
Mn%	:	0.50 - 0.80
Si%	:	0.30 max
S%	:	0.03 max
P%	:	0.03 max
YS	:	400 Mpa min.
UTS	:	500 Mpa min.
Elg % (L=5d)	:	22 min.
CVN Impact	:	30 Joules min.
		at -30°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	80-140
4.00	120-180
5.00	180-240
	DC(+)

RUTILE COATED MILD STEEL ELECTRODES

SHIIVA TOUCH

Classification : AWS A 5.1 : E-6013, IS : ER 4112

A general purpose medium coated electrode for fabrication mild steel like IS 2062 and sheet metal work used for fabrication tanks, pipe lines rail wagons, auto bodies, furniture, machinery construction. The electrode is characterised by stable and smooth arc, low spatter, easy detachable slag, smooth and well rippled shining bead and good mechanical properties

Weld Metal Properties

C%	:	0.12 max
Mn%	:	0.30 - 0.60
Si%	:	0.40 max
S%	:	0.04 max
P%	:	0.04 max
YS	:	330 Mpa min.
UTS	:	410 - 540 Mpa
Elg % (L=5d)	:	24 min.
CVN Impact	:	47 Joules min.
		at 27 °C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
	AC/DC(-)
	OCV 50 V

APPROVALS : BIS, RDSO-Class-A1

FERROCORD

Classification : AWS A 5.1 : E-6013, IS : ER 4211

A rutile coated general purpose mild steel electrode, which operates on low OCV of 50V AC in all positions. It gives smooth and stable welding arc with low spatter and smoke, excellent slag detachability and smooth shining bead appearance. Suitable for general structural welding, pipe sockets, grill, steel furniture, truck & bus bodies, storage tanks, sheet metal fabrication and general repair welding in automobile garages etc.

APPROVALS : BIS

BSP Ancillary

Weld Metal Properties

C%	:	0.10 max
Mn%	:	0.32 - 0.60
Si%	:	0.30 max
S%	:	0.03 max
P%	:	0.03 max
YS	:	330 Mpa min.
UTS	:	410 - 540 Mpa.
Elg % (L=5d)	:	22 min.
CVN Impact	:	47 Joules min.
		at 0 °C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
6.30	240-280
	AC/DC()
	OCV 50 V

SHIVA-S**Classification : AWS A 5.1 : E-6013, IS : ER 4212X**

A medium rutile coated, all position electrode for general fabrication and structural work. Excellent welding properties include smooth arc, easy slag removal, minimum spatter and well rippled bead with good finish. Excellent mechanical properties with radiographic quality welds. Suitable for boilers, pipelines, pressure vessels, ship hull, bridges, storage tanks, etc.

APPROVALS : BIS, BV, IRS, IBR, D.M.R.C. Ltd., BHEL, Thermax Ltd., MN Dastur

Weld Metal Properties

C%	:	0.12 max
Mn%	:	0.32 - 0.60
Si%	:	0.40 max
S%	:	0.04 max
P%	:	0.04 max
YS	:	330 Mpa min.
UTS	:	410 - 540 Mpa.
Elg % (L=5d)	:	22 min.
CVN Impact	:	47 Joules min. at 0°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-190
5.00	180-250
AC/DC(-)	

SHIVA-SS**Classification : AWS A 5.1 : E-6013, IS : ERR 4222X**

A rutile base heavy coated electrode which deposits radiographic quality welds having sound mechanical properties. Excellent bead appearance and self peeling slag. Good running characteristics with higher welding speed. The electrode can be used for "touch welding" It can be used for special welding jobs where higher quality welds are required, which includes pressure vessels, furnace shells, boilers, ship hulls, heavy structures and bridges, heavy fabrication jobs etc.

APPROVALS : BIS**Weld Metal Properties**

C%	:	0.12 max
Mn%	:	0.32 - 0.60
Si%	:	0.40 max
S%	:	0.04 max
P%	:	0.04 max
YS	:	330 Mpa min.
UTS	:	410 - 540 Mpa.
Elg % (L=5d)	:	22 min.
CVN Impact	:	47 Joules min. at 0°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-190
5.00	190-240
AC/DC(-) OCV 50 V	

SHIVA-7014**Classification : AWS A 5.1 : E-7014, IS : ERR 5222JX**

A medium heavy coated, iron powder, rutile type electrode for welding all mild steel structures. The electrode is capable of taking higher currents and thus gives higher welding output. Welds are of radiographic quality and the deposition efficiency is 110% approx. Suitable for all types of joints to achieve faster speed and higher welding output. Typical applications include boilers, pressure vessels, wagons girders, tanks, ships, machine parts etc.

Weld Metal Properties

C%	:	0.10 max
Mn%	:	0.65 max
Si%	:	0.30 max
S%	:	0.03 max
P%	:	0.03 max
YS	:	360 Mpa min.
UTS	:	510 - 610 Mpa.
Elg % (L=5d)	:	20 - 28
CVN Impact	:	47 Joules min. at 0°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-150
4.00	160-200
5.00	200-260
AC/DC(-)	

SHIVA - 7024**Classification : AWS A 5.1 : E- 7024, IS : ERR 5242KX**

A Super heavy coated rutile based iron powder type electrode designed to weld heavy fabrication jobs. High deposition efficiency of approx 140% reduces welding time and increases the output. weld metal is sound and is of radiographic quality. Ideal for "touch welding" in flat and horizontal positions. Suitable for heavy structures like crane and bridge girders, ship building, locomotives, boilers, assembly of earthmoving equipments etc.

Weld Metal Properties

C%	:	0.10 max
Mn%	:	0.60 - 1.00
Si%	:	0.50 max
S%	:	0.03 max
P%	:	0.03 max
YS	:	360 Mpa min.
UTS	:	510 - 610 Mpa.
Elg % (L=5d)	:	20 min
CVN Impact	:	47 Joules min. at 0°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	130-170
4.00	200-240
5.00	250-290
AC/DC(-)	

LOW HYDROGEN AND LOW ALLOYS ELECTRODES

SHIVA - 7016

Classification : AWS A 5.1 : E-7016, IS : EB 5426 H₃X

A medium heavy coated, all position, low hydrogen electrode for welding of carbon steels. The weld metal is extremely tough, ductile and of Radiographic quality. Weld metal possesses sound mechanical properties and good impact strength at sub zero temperatures. Suitable for mild steel, medium high tensile steels, difficult steels of unknown composition and for non-machinable deposits on cast iron. Typical applications include heavily restrained joints, boilers, ship building, high sulphur steels, earth moving machinery, rotary kiln shells, cast irons.

APPROVALS : BIS

Weld Metal Properties

C%	:	0.12 max
Mn%	:	1.40 max
Si%	:	0.75 max
S%	:	0.035 max
P%	:	0.035 max
YS	:	360 Mpa min.
UTS	:	510 - 610 Mpa
Elg % (L=5d)	:	20 min.
CVN Impact	:	27 Joules min.
		at -30°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	90-140
4.00	140-200
5.00	190-250
6.30	250-300
AC / DC(+) OCV 70V	

SHIVATHERME - 18

Classification : AWS A 5.1 : E-7018, IS : EB 5426 H₃JX

A heavy basic coated, low hydrogen iron powder type electrode with excellent welding properties. The weld metal is ductile crack resistant and is of radiographic quality. Specially recommended for heavy joints under restraint and subject to dynamic loading. Deposition efficiency 115% approx. Suitable for welding pressure vessels, boilers, penstocks, ship construction, highly restrained joints, coaches, wagons, earth moving machines etc.

APPROVALS : BIS, IRS, BV, IBR, D.M.R.C. Ltd., BHEL, Thermax Ltd., MN Dastur

Weld Metal Properties

C%	:	0.12 max
Mn%	:	1.60 max
Si%	:	0.75 max
S%	:	0.035 max
P%	:	0.035 max
YS	:	360 Mpa min.
UTS	:	510 - 610 Mpa.
Elg % (L=5d)	:	24 min.
CVN Impact	:	27 Joules min.
		at -30°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-140
4.00	140-190
5.00	200-250
6.30	250-300
AC / DC(+) OCV 70V	

SHIVA - 18 (SPL)

Classification : AWS A 5.1 : E 7018-1, IS : EB 5626 H₃JX

A heavy coated low hydrogen iron powder type of electrode, specially designed for high impact values down to - 50°C. The weld metal is very resistant to hot cracking, is of excellent radiographic quality and has excellent impact toughness even at -50°C. Suitable for carbon steels, steels sensitive to hydrogen embrittlement, heavy and rigid structures, pressure vessels, penstocks, parts of earth moving equipment, bridges, low alloy steel and heavy thick plates of carbon steel.

Weld Metal Properties

C%	:	0.12 max
Mn%	:	1.20 - 1.60
Si%	:	0.75 max
S%	:	0.035 max
P%	:	0.035 max
YS	:	400 Mpa min.
UTS	:	510 - 610 Mpa.
Elg % (L=5d)	:	22 min.
CVN Impact	:	27 Joules min
		at -45°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	80-100
3.15	100-150
4.00	150-190
5.00	220-280
6.30	250-300
AC / DC(+) OCV 70V	

SHIVA-18 Ni

Classification : AWS A 5.5 : E-7018-G, IS : EXB-G1-26 Fe

A medium heavy coated iron powder, low hydrogen type electrode specially designed for welding fine grained steels. The weld metal is of radiographic quality and has good impact strength at down to minus 50°C. Suitable for welding heavy sections, restrained joints, requiring good notch toughness down to - 50°C and for welding fine grained steels containing Ni up to 1%.

Weld Metal Properties

C%	:	0.10 max
Mn%	:	1.40 - 1.70
Si%	:	0.30 - 0.50
S%	:	0.03 max
P%	:	0.03 max
Ni%	:	0.50 - 0.75
YS	:	390 Mpa min.
UTS	:	490 Mpa min.
Elg % (L=5d)	:	22 min.
CVN Impact	:	27 Joules min
		at -45°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	80-100
3.15	110-140
4.00	140-190
5.00	200-240
6.30	250-300
AC / DC(+) OCV 70V	

SHIVA-18 Ni (SPL)

Classification : AWS A 5.5 : E 8018G, IS : E55BG 129 Fe

A medium heavy coated hydrogen controlled iron powder type electrode. Specially designed for high tensile fine grained steels which is highly resistant to hot and cold cracking even under dynamic loading heavy impact and severe service conditions with particular reference to low temperature service down to minus 60°C, Recommended for welding of fine grained, high strength Q & T steels, penstocks, pressure vessels etc.

Weld Metal Properties

C%	: 0.10 max
Mn%	: 1.20 - 1.70
Si%	: 0.60 max
S%	: 0.03 max
P%	: 0.03 max
Ni%	: 0.05 - 0.10
Mo%	: 0.30 max
YS	: 450 Mpa min.
UTS	: 550 Mpa.
Elg % (L=5d)	: 19 min.
CVN Impact at -60°C	: 50 Joules min

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	80-100
3.15	110-140
4.00	160-190
5.00	220-280
AC/DC(+)	

SHIVA - 9018 G

Classification : AWS A 5.5 : E 9018 G,IS: E63 BG 126

A medium heavy coated, all position, hydrogen controlled iron powder type electrode for welding 70 Kg / mm² class high tensile steel. The weld metal possesses excellent toughness at sub zero temperatures down to minus 50°C. Recommended for welding fine grained steels, high tensile steels used in bridges, penstocks, tanks, pressure vessels, boilers, earth moving equipment and heavy structural fabrication.

Weld Metal Properties

C%	: 0.10 max
Mn%	: 1.20 - 1.70
Si%	: 0.80 max
S%	: 0.03 max
P%	: 0.03 max
Mo%	: 0.25 - 0.45
YS	: 530 Mpa min.
UTS	: 620 Mpa min.
Elg % (L=5d)	: 17 min.
CVN Impact at -50°C	: 30 Joules min

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-140
4.00	140-190
5.00	200-250
AC/DC(+)	

SHIVA - 90 D1

Classification : AWS A 5.5 : E 9018 G, IS: E63 BG 126 J

A medium heavy coated, all position, hydrogen controlled iron powder type electrode for welding 70 Kg / mm² class high tensile steel. The weld metal possesses excellent toughness at sub zero temperatures down to minus 50°C. Recommended for welding fine grained steels, high tensile steels used in bridges, penstocks, tanks, pressure vessels, boilers, earth moving equipment and heavy structural fabrication. Deposition efficacy is approx 120%

Weld Metal Properties

C%	: 0.09 max
Mn%	: 1.20 - 1.70
Si%	: 0.80 max
S%	: 0.03 max
P%	: 0.03 max
Mo%	: 0.25 - 0.45
YS	: 530 Mpa min.
UTS	: 620 Mpa min.
Elg % (L=5d)	: 17 min.
CVN Impact at -50°C	: 30 Joules min

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-140
4.00	140-190
5.00	200-250
AC/DC(+)	

SHIVA - 10016 G

Classification : AWS A 5.5: E-10016 G, IS: E-68 BG 126

A medium heavy coated, hydrogen controlled, low alloy all position electrode. The weld metal is of radiographic quality and possesses excellent strength combined with good toughness. Suitable for welding high strength steels, Q & T steels, having UTS in the range of 70 kg/mm². The extra low hydrogen levels ensure freedom from hydrogen induced cracking.

Weld Metal Properties

C%	: 0.10 max,	Si%	: 0.60 max
S%	: 0.03 max,	P%	: 0.03 max
Mn%	: 1.20 - 1.70		
Ni%	: 1.25 - 2.20		
Mo%	: 0.25 - 0.50		
Cr%	: 0.40 max		
YS	: 600 Mpa min.		
UTS	: 690 Mpa min.		
Elg % (L=5d)	: 16 min.		
CVN Impact at -50°C	: 30 Joules min		

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-150
4.00	140-190
5.00	190-240
AC/DC(+)	

SHIVA - 11018 - M

Classification : AWS A 5.5 : E-11018 M
IS : E 76 BM 329 Fe

A low hydrogen, low alloy, iron powder electrode for welding high tensile, fully killed, fine grained, quenched and tempered steels. Radiographic quality weld metal which is tough, ductile and resistant to cracking. Ideal for welding heavy duty structure, penstocks, earth moving equipment, low alloy high tensile steels, such as HY-80, HY-90 and T-1 steels, SA-517 grade and their equivalent.

Weld Metal Properties

C%	: 0.10 max,	Si%	: 0.60 max
S%	: 0.03 max,	P%	: 0.03 max
Mn%	: 1.20 - 1.80		
Ni%	: 1.25 - 2.50		
Mo%	: 0.25 - 0.50		
Cr%	: 0.40 max		
YS	: 680 Mpa min.		
UTS	: 760 Mpa min.		
Elg % (L=5d)	: 20 min.		
CVN Impact	: 30 Joules min		
	at -50°C		

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-250
AC/DC(+)	

SHIVA - 18 - A1

Classification : AWS A 5.5 : E7018-A1,
IS : E49B A1 26Fe

A heavy coated low hydrogen iron powder type electrode specially meant for welding carbon molybdenum creep resisting steels. The weld metal containing 0.5% Mo and welds are of radiographic quality. Suitable for welding 0.5% Mo and 1% Cr-0.5% Mo steels, heat and creep resisting steels, for service temp. up to 525°C, boilers, pressure vessels, pipe lines, storage tanks, reaction vessels etc.

Weld Metal Properties

C%	: 0.10 max
Mn%	: 0.90 max
Si%	: 0.60 max
S%	: 0.03 max
P%	: 0.03 max
Mo%	: 0.40 - 0.65
YS	: 400 Mpa min.
UTS	: 520 - 620 Mpa.
Elg % (L=5d)	: 22 min.
CVN Impact	: 140 - 200 Joule
	at 27°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-250
AC/DC(+)	

SHIVA - CR - 1

Classification : AWS A 5.5 : E 8018-B2
IS : E 55 BB 226 Fe

A heavy coated low hydrogen iron powder type electrode suitable for chromium-molybdenum creep and heat resisting steels. The weld metal contains about 1.25% Cr and 0.5% Mo and has excellent creep and heat resistance up to 550°C Gives radiographic quality welds. Recommended for welding 1 Cr 0.5 Mo steels, used in boilers, super heaters, pipe lines, oil refineries etc.

Weld Metal Properties

C%	: 0.05 - 0.12
Mn%	: 0.90 max
Si%	: 0.80 max
S%	: 0.03 max
P%	: 0.03 max
Mo%	: 0.40 - 0.65
Cr%	: 1.00 - 1.50
YS	: 450 Mpa min.
UTS	: 560 Mpa
Elg % (L=5d)	: 19 min.
CVN Impact at 27°C :	50 - 100 Joule

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
AC/DC(+)	

SHIVA - CR - 2

Classification : AWS A 5.5 : E 9018-B3
IS : E 52 BB 326 Fe

A heavy coated low hydrogen iron powder type electrode specially designed to weld high tensile chromium-molybdenum heat and creep resisting steels. The weld metal contains about 2% Cr. and 1% Mo and is of radiographic quality and has creep resistance up to 600°C suitable to weld high tensile heat and creep resisting steels having composition of about 2% Cr and 1% Mo alloy steels, boiler, pressure vessels, high temperature reaction vessels and steels of grade A 234, A 235, A 236, A 387, A 426 etc.

Weld Metal Properties

C%	: 0.05 - 0.12
Mn%	: 0.90 max
Si%	: 0.80 max
S%	: 0.03 max
P%	: 0.03 max
Mo%	: 0.90 - 1.20
Cr%	: 2.00 - 2.50
YS	: 530 Mpa min.
UTS	: 620 Mpa
Elg % (L=5d)	: 17 min.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
AC/DC(+)	

SHIVA - CR - 5

**Classification : AWS A 5.5 : E-8018-B6,
IS : E 41 BB 626 Fe**

A basic coated electrode specially designed for welding 5% Cr- 0.5% Mo steels used for pipes and tubes which are mainly used in chemical, oil and petroleum industries. The weld metal is of radiographic quality and has excellent creep resistance up to 550°C. Recommended for welding of 5% Cr 0.5% Mo steels for high temperature applications in oil refineries, power plants, chemical plants, fertilizer and pharmaceutical industries.

Weld Metal Properties

C%	:	0.05 - 0.10
Mn%	:	0.50 - 0.90
Si%	:	0.25 - 0.65
S%	:	0.03 max
P%	:	0.03 max
Mo%	:	0.45 - 0.65
Cr%	:	4.00 - 6.00
YS	:	450 Mpa min.
UTS	:	550 - 650 Mpa.
Elg % (L=5d)	:	20 min.
CVN Impact at 27°C	:	80 - 140 Joule
Hardness	:	225 BHN max

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
AC/DC(+)	

SHIVA - CR - 9

Classification : AWS A 5.5 : E 8018-B8, IS : E 55 BB 820

A basic coated electrode depositing air hardening type Cr-Mo alloy highly resistant to corrosion, oxidation and scaling up to 700°C with high temperature creep and tensile strength. Recommended for welding 9% Cr-1% Mo steels in the form of plates, pipes, tubes are used in many industries such as oils, chemicals, petroleum refineries and acid plants, where high degree of corrosion resistance and creep strength is desired at elevated temperatures.

Weld Metal Properties

C%	:	0.05 - 0.10
Mn%	:	0.50 - 0.90
Si%	:	0.25 - 0.65
S%	:	0.03 max
P%	:	0.03 max
Mo%	:	0.85 - 1.20
Cr%	:	8.00 - 10.00
YS	:	450 Mpa min.
UTS	:	550 - 650 Mpa.
Elg % (L=5d)	:	20 min.
Hardness	:	240 BHN max

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60-90
3.15	100-140
4.00	140-180
5.00	180-240
AC/DC(+)	

SHIVA - 8018 - W2

**Classification: AWS A 5.5 : E 8018-W2,
IS: E55 Bg126 Fe**

A basic coated all position electrode, designed for welding of weathering steels such as corten-A, corten- B etc. The weld metal has excellent resistance to atmospheric corrosion and is of radiographic quality. Suitable for welding high tensile steels and steels containing approx. Cr- 0.5%, Ni 0.5%, Cu 0.5% specially recommended for welding steels like corten steels used in chemical, petrochemical and railway industries to resist atmospheric corrosion.

Weld Metal Properties

C% : 0.12 max,	Si% : 0.35 - 0.80
Mn% : 0.50 - 1.30,	Cu% : 0.30 - 0.75
S% : 0.03 max,	P% : 0.03 max
Ni% : 0.40 - 0.80,	Cr% : 0.45 - 0.70
YS	: 460 Mpa min.
UTS	: 550 Mpa.
Elg % (L=5d)	: 19 min.
CVN Impact at -20°C	: 50 Joule min.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	110-140
4.00	150-190
5.00	200-250
AC/DC(+)	

HARD SURFACING ELECTRODES**SHIVA - HF I**

A medium heavy coated rutile type electrode, The weld deposit an air hardening type, carbon-chromium-manganese alloy having a hardness of approx. 250 BHN. The weld metal is machinable. Suitable for gears, shafts, axles pinion teeth and machinery parts where moderate hardness and toughness combined with easy machinability is required.

Weld Metal Properties

C%	:	0.25 max
Mn%	:	0.20 - 0.60
Si%	:	0.20 - 0.50
Cr%	:	1.00 - 2.00
Hardness	:	250 - 320 BHN (On 2 layers)

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	100-140
4.00	140-180
5.00	180-220
AC/DC(-)	

SHIVA - HF - II

A medium heavy coated rutile type electrode for hard facing of steels subjected to wear due to abrasion & impact. The weld metal gives a hardness of 350 BHN and crack free weld metal joints, weld is having good machinability. Suitable for hard facing on mild steel, carbon steel & low alloy steels, Gears, shafts, shear blades, roller, brake shoes, crane wheels, wobblers, axles, pulleys, pinion teeth and machinery parts where resistance to abrasion combined with toughness is required.

Weld Metal Properties		Recommended Current Ranges	
C%	: 0.20 - 0.40	Size (MM)	Current Range (Amps)
Mn%	: 0.40 - 0.80		
Si%	: 0.60 max		
Cr%	: 2.50 - 3.00	3.15	100-140
		4.00	140-180
Hardness	: 350 - 450 BHN on 2 layers	5.00	180-220
AC/DC(-)			

SHIVA - HF - III

A medium heavy coated rutile type, air-hardening type electrode gives approx-600 BHN hardness. welds is non-machinable and can only be ground. The electrode is recommended for hard facing where severe conditions of abrasion, friction, accompanied by moderate impact exist. Suitable for dredger bucket lips, plough shares, excavator teeth, conveyer buckets, brake shoes, road graders, shear blades etc. Before depositing on carbon steels, a buffer layer with SHIVA-7016 is recommended.

Weld Metal Properties		Recommended Current Ranges	
C%	: 0.40 - 0.60	Size (MM)	Current Range (Amps)
Mn%	: 0.60 - 1.00		
Si%	: 0.50 max		
Cr%	: 5.00 - 8.00	3.15	100-140
Mo%	: 0.50 max	4.00	140-180
		5.00	180-220
Hardness	: 550 - 600 BHN (On 2 layers)		
AC/DC(-)			

SHIVA - HF - III (LH)

A medium heavy coated, low hydrogen electrode depositing an air hardening type of weld metal of approx 600 BHN hardness. The deposits is free from cracks, porosity has excellent resistance to abrasion, friction and moderate impact. For most of the application the electrode can be used directly on the job without the necessity of putting a buffer layer. The weld is not machinable and can only be ground. Recommended for parts of earth-moving machinery, cane cutting knives, crusher hammers, jaws, rollers, rock drills, scraper blades, tractor grousers, oil expeller worms, hot and cold punching dies etc.

Weld Metal Properties		Recommended Current Ranges	
C%	: 0.50 - 0.80	Size (MM)	Current Range (Amps)
Mn%	: 1.00 Max		
Si%	: 0.60 - 1.10		
Cr%	: 6.50 - 8.00	3.15	100-140
V%	: 0.40 - 0.80	4.00	140-180
Mo%	: 0.40 - 0.80	5.00	180-220
Hardness	: 540 - 650 BHN (on 2 layers)		
AC/DC(+)			

SHIVA - HF - V

A medium heavy coated, low hydrogen type, hardfacing electrode depositing alloyed cast iron type of weld metal which has excellent resistance to severe abrasion with moderate impact. The hardness of the weld deposit is approx 600 BHN and welds non-machinable. suitable for concrete mixer blades, excavator teeth, bucket lips, oil expeller worms, muller tyres, cement die rings, screw conveyers, scraper blades etc.

Weld Metal Properties		Recommended Current Ranges	
C%	: 2.00 - 3.00	Size (MM)	Current Range (Amps)
Mn%	: 0.80 - 1.30		
Si%	: 2.00 - 3.50		
Cr%	: 2.50 - 4.00	3.15	100-130
		4.00	140-180
Hardness	: 550 - 650 BHN (on 2 layers)	5.00	170-200
AC/DC(-)			

SHIVA - MANGAN

A medium heavy basic coated, low hydrogen type of electrode, depositing austenitic weld metal of 14% Mn. The deposit is tough work hardens to more than 500 BHN in service and has excellent resistance to wear by impact. Recommended for austenitic manganese steel parts such as dredger bucket teeth, stone crushing jaws, crusher hammers, cement grinder rings, rail frogs and switches, muller tyres and austenitic manganese steel casting etc. When used on mild steel, carbon steel or low alloy steel parts, give a buffer layer of SHIVA-CHROM-N.

Weld Metal Properties

C%	:	1.00 max
Mn%	:	12.0 - 14.0
Si%	:	0.80 max
Hardness	:	As welded 170 - 220 BHN Work hardness 400-500 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	90-120
4.00	130-170
5.00	170-200
AC/DC(+)	

STAINLESS STEEL ELECTRODES

SHIVA - 308

Classification : AWS A 5.4 : E 308 -16,
IS : 5206 E 19.9 R 26

A rutile coated stainless steel electrode for welding of 18% Cr, 8% Ni steels like AISI 302, 304, 308 etc. The weld metal has good resistance to cracking, corrosion and scaling up to 800°C. Suitable for welding house hold articles, Drug and pharmaceutical equipment. Apparatus for chemical acids, milk, soap and fertilizers Industries.

APPROVAL : BIS

Weld Metal Properties

C%	:	0.08 max
Mn%	:	0.50 - 2.50
Si%	:	1.00 max
Ni%	:	9.00 - 11.00
S%	:	0.03 max
P%	:	0.04 max
Cr%	:	18.0 - 21.0
UTS	:	550 Mpa min.
Elg	:	30 - 45
Delta Ferite	:	3.0 - 7.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50-70
3.15	80-100
4.00	100-140
5.00	150-180
AC/DC(+)	

SHIVA - 347

Classification : AWS A 5.4 : E-347-16,
IS : 5206-83 E 19.9 Nb R 26

A niobium stabilized stainless steel electrode for welding of Nb or Ti Stabilized steels of the 19 Cr, 10 Ni type. Nb prevents harmful carbide precipitation in the temperature range 425° to 843°C. The weld metal has excellent resistance to intergranular corrosion and creep strength. Suitable for welding of AISI 304, 308, 321 and 347 and their equivalents.

Weld Metal Properties

C%	:	0.08 max
Mn%	:	0.50 - 2.50
Si%	:	1.00 max
S%	:	0.03 max
P%	:	0.04 max
Nb%	:	0.20 - 1.00
Cr%	:	18.0 - 21.0
Ni%	:	9.00 - 11.00
UTS	:	520 Mpa min
Elg %	:	30 - 40
Delta Ferite	:	6.0 - 9.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50-70
3.15	80-100
4.00	100-140
5.00	150-180
AC/DC(+)	

SHIVA - 308 - L

Classification : AWS A 5.4 : E-308L-16,
IS : 5206-83 E 19.9 LR 26

An extra low carbon 19 Cr-10 Ni type stainless steel electrode which has excellent resistance to intergranular corrosion. The weld metal has higher resistance to cracking oxidation and scaling at elevated temperature up to 800°C. The weld metal has excellent creep strength and is of radiographic quality. Suitable for welding low carbon austenitic stainless steel like AISI 304 L, 308L and equivalent grades used for hospital apparatus, dairy equipment, chemical and fiber industries etc.

Weld Metal Properties

C%	:	0.04 max
Mn%	:	0.50 - 2.50
Si%	:	1.00 max
S%	:	0.03 max
P%	:	0.04 max
Cr%	:	18.0 - 21.0
Ni%	:	9.00 - 11.00
UTS	:	550 Mpa min
Elg %	:	30 - 40
Delta Ferite	:	3.0 - 7.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50 - 70
3.15	80-100
4.00	100-140
5.00	150-180
AC/DC(+)	

SHIVA - 309

**Classification : AWS A 5.4 : E 309-16,
IS : 5206-83 E 23.12 R 26**

A medium heavy coated rutile type all position electrode producing 25 Cr-12 Ni type weld metal having excellent resistance to corrosion and oxidation up to 1100°C. Recommended for AISI 309 grade of stainless steel and straight chrome steels, dissimilar steels such as joining mild steel and low alloy steel to stainless steel, overlays on ferritic steels and difficult to weld steels.

Weld Metal Properties

C%	: 0.15 max
Mn%	: 0.50 - 2.50
Si%	: 1.00 max
S%	: 0.03 max
P%	: 0.04 max
Cr%	: 22.0 - 25.0
Ni%	: 12.0 - 14.0
UTS	: 550 Mpa min
Elg %	: 30 - 45
Delta Ferite	: 8.0 - 15.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60 - 80
3.15	80 - 110
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 309 L

**Classification : AWS A 5.4 : E 309L-16,
IS : E5206-83 E 23.12 LR 26**

A rutile based, extra low carbon, all position electrode depositing 24 Cr-12 Ni weld metal for joining of stainless steel to mild steel. The extra low carbon content prevents carbide precipitation and hence avoids intergranular corrosion. It has excellent corrosion and oxidation resistance in continuous service up to 1100°C. Suitable for heat resistant straight chrome steels, AISI 309 type steels, also recommended for joining stainless to mild steel, low alloy steels and also used widely for surfacing of mild steel and building up worn out parts for wear resistant steels.

Weld Metal Properties

C%	: 0.04 max
Mn%	: 0.50 - 2.50
Si%	: 1.00 max
S%	: 0.03 max
P%	: 0.04 max
Cr%	: 22.0 - 25.0
Ni%	: 12.0 - 14.0
UTS	: 550 Mpa min
Elg %	: 30 - 45
Delta Ferite	: 8.0 - 15.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60 - 80
3.15	80 - 110
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 309 - Cb

**Classification : AWS A 5.4 : E 309 Cb-16
IS : 5206-83 E- 23.12 Nb R 26**

A medium heavy coated rutile type, all position stainless steel electrode, producing 23 Cr -12 Ni type of weld metal. Stabilised with columbium. The weld metal has excellent resistance to chemical corrosion and heat up to 1100°C. Suitable for welding AISI 309, 309 Cb steels and straight chrome steels. Joining stainless steel to low alloy steels and carbon steels, suitable for over laying on ferritic steels.

Weld Metal Properties

C%	: 0.12 max
Mn%	: 0.50 - 2.50
Si%	: 1.00 max
P%	: 0.04 max
S%	: 0.03 max
Cb%	: 0.70 - 1.00
Cr%	: 22.0 - 25.0
Ni%	: 12.0 - 14.0
UTS	: 600 Mpa min
Elg %	: 30 - 40
Delta Ferite	: 8.0 - 15.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60 - 80
3.15	80 - 110
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 309 Mo

**Classification : AWS A 5.4 : E 309 Mo-16
IS : 5206-83 E 23.12.2 R 26**

A medium heavy coated rutile type all position stainless steel electrode, depositing 23 Cr/12 Ni/2.5 Mo type of weld metal. The weld metal possess excellent resistance to chemical corrosion and heat up to 1100°C. Suitable for welding of 316 type clad steels, dissimilar metal joining between MS and low alloy steels and stainless steels. Overlaying and buffering applications.

Weld Metal Properties

C%	: 0.12 max
Mn%	: 0.50 - 2.50
Si%	: 1.00 max
S%	: 0.03 max
P%	: 0.04 max
Mo%	: 2.0 - 3.00
Cr%	: 22.0 - 25.0
Ni%	: 12.00 - 14.00
UTS	: 550 Mpa min
Elg %	: 30 - 40
Delta Ferite	: 12.0 - 15.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50 - 70
3.15	80 - 100
4.00	100 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 310**Classification : AWS A 5.4 : E 310-16,****IS : 5206-83 E 25.20 R 26**

A medium heavy coated, basic-rutile type austenitic stainless steel electrode depositing 25 Cr-20 Ni type weld metal which has excellent resistance to oxidation and scaling up to 1200°C in continuous service. The weld metal is fully austenitic and is of radiographic quality. Suitable for welding AISI 310 type of stainless steel, clad steels, straight chrome steels, gas turbine high temperature furnace parts, broken dies, annealing boxes, armour plates, hydrogenation plants polymerization plants etc.

Weld Metal Properties

C%	:	0.08 - 0.20
Mn%	:	1.00 - 2.50
Si%	:	0.75 max
S%	:	0.03 max
P%	:	0.03 max
Cr%	:	25.0 - 28.0
Ni%	:	20.0 - 22.5
UTS	:	550 Mpa min
Elg %	:	30 - 40

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60 - 80
3.15	80 - 110
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 312**Classification: AWS A 5.4 : E-312-16, IS : E29.9 R 26**

A medium heavy coated, rutile type electrode, specially designed for welding similar and dissimilar steels. It produces crack-free high strength joint in carbon steel, low alloy steel, stainless steel including difficult to weld steels. Ideally suited for welding of a variety of unknown composition steels, die and spring steel, high temperature steel and other difficult to weld steels. Also suitable for building up or cushioning prior to hard facing on very high strength and high hardness deposit and hot working tools, dies for plastics etc.

Weld Metal Properties

C%	:	0.15 max
Mn%	:	0.70 - 2.00
Si%	:	1.00
P%	:	0.03 max
S%	:	0.03 max
Mo%	:	0.75 max
Cr%	:	28.0 - 32.0
Ni%	:	8.0 - 11.0
UTS	:	600 Mpa min
Elg %	:	22 - 25

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	60 - 80
3.15	80 - 110
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 316**Classification : AWS A 5.4 : E 316-16,****IS : E 19.12.2 R 26**

A rutile coated stainless steel electrode depositing weld metal of 18 Cr -11 Ni - 2.3 Mo with controlled ferrite. The weld metal has excellent resistance to corrosion, cracking and creep strength at elevated temperatures up to 850°C. The presence of molybdenum improves the corrosion resistance in reducing media. Suitable for wide range of applications such as AISI 316 and 317 type steels, vessels handling chemical and acids, vats used in the pulp, paper and textile industries.

Weld Metal Properties

C%	:	0.08 max
Mn%	:	0.50 - 2.50
Si%	:	1.00 max
S%	:	0.03 max
P%	:	0.04 max
Mo%	:	2.00 - 3.00
Cr%	:	17.0 - 20.0
Ni%	:	11.0 - 14.0
UTS	:	550 Mpa min
Elg %	:	30 - 40
Delta Ferite	:	5.0 - 8.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50 - 75
3.15	80 - 100
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - 316 L**Classification : AWS A 5.4 : E 316 L -16****IS : E 19.12.2 LR 26**

A stainless steel electrode depositing an extra low carbon 18 Cr-12 Ni 2.3 Mo weld metal with controlled ferrite. The deposit exhibits exceptional corrosion resistance to acids, salts and pitting attack by chlorides. The low level of carbon content ensures excellent intergranular corrosion resisting properties of the weld metal at elevated temperatures up to 850°C. Suitable for welding stainless steel of grades AISI 316, 316 L or 317, chemical tanks, Paper mills, Chemical plants, paint & dye industries etc.

Weld Metal Properties

C%	:	0.04 max
Mn%	:	0.50 - 2.50
Si%	:	1.00 max
S%	:	0.03 max
P%	:	0.04 max
Mo%	:	2.0 - 3.0
Cr%	:	17.0 - 20.0
Ni%	:	11.00 - 14.00
UTS	:	530 Mpa min
Elg %	:	30 - 40
Delta Ferite	:	5.0 - 8.0 FN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	50 - 75
3.15	80 - 100
4.00	110 - 140
5.00	150 - 180
AC/DC(+)	

SHIVA - CR - 13**Classification : AWS A 5.4 : E 410-16**

A heavy coated low hydrogen type electrode specially designed for welding 13% martensitic chromium steels and castings and worn out parts of several machines. The weld deposit is an air hardening type alloy. oxidation and corrosion resistibilities of weld metal are good. suitable for joining similar alloys, surfacing of turbine blades, valve seats, gas turbine components, straight chromium steels, pump parts, components in oil refineries, coal washers etc.

Weld Metal Properties		Recommended Current Ranges	
		Size (MM)	Current Range (Amps)
C%	: 0.12 max		
Mn%	: 1.00 max		
Si%	: 0.90 max		
P%	: 0.04 max	2.50	50-70
S%	: 0.03 max	3.15	80-120
Cr%	: 11.0 - 13.5	4.00	130-160
Ni%	: 0.70 max	5.00	170-220
UTS	: 490 Mpa min	AC/DC(+)	
Elg %	: 20 min.		

SHIVA - CR - 17**Classification : AWS A 5.4 : E 430-16**

A heavy basic coated low hydrogen electrode specially designed for welding AISI 430 stainless steel. The electrode deposits about 17% Cr alloy which is highly resistant to corrosion, oxidation and scaling up to 900°C. Suitable for surfacing and welding of straight chrome steels, valves, impellers, turbine blades, oil burner parts, automobile body moulding etc.

Weld Metal Properties		Recommended Current Ranges	
		Size (MM)	Current Range (Amps)
C%	: 0.10 max		
Mn%	: 1.00 max		
Si%	: 0.90 max		
S%	: 0.03 max	2.50	50-80
P%	: 0.04 max	3.15	80-110
Cr%	: 15.0 - 18.0	4.00	110-160
Ni%	: 0.6 max	5.00	160-200
UTS	: 490 Mpa min	AC/DC(+)	
Elg %	: 20 min		

SHIVA - 307**Classification : IS 5206 : E18.8 Mn R 26**

A medium coated stainless steel electrode with a stainless steel core wire depositing 18 Cr, 8 Ni, 5 Mn weld deposit which has excellent crack resistance, corrosion resistance and heat resistance up to 900°C. Recommended for joining austenitic manganese steel to mild steel, crack free joints in difficult steels and high alloy steels including armor plates, repairing cracks in austenitic manganese steel castings, for surfacing manganese steel rails, laying buffer layer on difficult steels before hard facing etc.

Weld Metal Properties		Recommended Current Ranges	
		Size (MM)	Current Range (Amps)
C%	: 0.12 max		
Mn%	: 5.0 - 8.0		
Si%	: 1.00 max		
S%	: 0.03 max		
P%	: 0.04 max	2.50	50-80
Cr%	: 18.0 - 21.0	3.15	80-110
Ni%	: 8.5 - 11.0	4.00	110-160
Mo%	: 0.50 - 1.50	5.00	160-200
UTS	: 600 - 650 Mpa	AC/DC(+)	
Elg %	: 30 - 40		
Delta Ferite	: 4.0 - 8.0 FN		
Hardness as welded	: 170 - 200 BHN		
Hardness after work	: Upto 450 BHN		

NON FERROUS ELECTRODES**SHIVA - SUPER MONEL****Classification : AWS A 5.15 : E Ni Cu-7**

A medium heavy coated, low hydrogen type electrode depositing monel type weld metal. The weld metal has good corrosion resistance to sea water, sulphuric acids and alkalis. suitable for welding monel, Ni-Cu alloy to themselves and to steels, Ni-Cu clad steel and for surfacing on steel parts for service against corrosion by sea water, chlorinated solvents, sulphuric acid and alkalis. Ideal for marine, chemical, food, dairy and oil refining industries.

Weld Metal Properties		Recommended Current Ranges	
		Size (MM)	Current Range (Amps)
C%	: 0.08 max		
Mn%	: 1.0 - 3.0		
Si%	: 0.20 - 0.80		
P%	: 0.35 max	2.50	40-80
Ni%	: 62.0 - 68.0	3.15	80-100
Ti%	: 0.30 - 1.00	4.00	110-140
Fe%	: 1.00 - 2.50	5.00	150-180
Cu%	: Balance		
UTS	: 490 - 590 Mpa	DC(+)	
Elg %	: 30 - 40		

SHIVA - BRONZE

Classification : AWS A 5.6 : E Cu Sn - A

A light coated electrode having basic type coating, specially designed for the welding of copper and bronze. The weld metal contains approx 92% Cu, 7% Sn and 0.35% max phosphorus for complete deoxidation. Suitable for welding Brass, Bronze, Deoxidised copper, cast iron steels, ship propellers, bearings, bus hinges, impeller blades, valve seats and dissimilar metals. It produces homogeneous and sound weld metal free from porosity and cracks. Excellent colour match with bronze.

Weld Metal Properties

Mn%	:	0.70 max
P%	:	0.35 max
Cu%	:	92.0 - 97.0
Sn%	:	4.0 - 7.0
UTS	:	250 - 350 Mpa
Elg %	:	20 min.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	40-70
3.15	60-110
4.00	110-160
5.00	160-200
DC(+)	

CAST IRON ELECTRODES

SHIVA-CAST

Classification : AWS A 5.15 : E St

A medium heavy coated graphite based electrode which produces non-machinable welds on cast iron, welds are strong and rigid joint between two cast iron parts. Non conductive coating prevents side arcing and good colour match with cast iron. Non-machinable weld deposits but can be ground. Suitable for welding of cast iron parts, for all types of general reclamation or repair work where machinability is not required, sealing oil-soaked cast iron defects, oxidized cast iron furnace equipment, joining cast iron to mild steel or low alloy steels, Also suitable for welding difficult steels, high carbon and sulphur. The weld display good abrasion resistance. Preheating is recommended for heavy and rigid sections.

Weld Metal Properties

C%	:	2.00 - 3.00
Mn%	:	1.00 max
Si%	:	4.00 - 6.00
UTS	:	320 - 450 Mpa
Hardness	:	250 BHN max

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	70-100
3.15	100-130
4.00	130-170
5.00	170-210
AC/DC(+)	

SHIVA- MONEL

Classification : AWS A 5.15 : E-Ni Cu-B,

A nickel-copper alloy electrode depositing a monel weld metal for welding of cast irons. Excellent for use in cast iron subjected to elevated temperatures & corrosive environment, Gives ductile & highly machinable weld deposits. Recommended for rebuilding of worn out cast iron castings, gear teeth, pump-impellers, pump casting, cylinder blocks, machine frames, joining cast iron to steels and to nickel copper alloys. The electrode is suitable for welding cast iron without preheat.

Weld Metal Properties

C%	:	0.35 - 0.55
Mn%	:	2.0 - 3.0
Si%	:	0.75 max
Ni%	:	60.0 - 70.0
Cu%	:	25.0 - 35.0
UTS	:	320 - 450 Mpa
Hardness	:	175 - 200 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	45-60
3.15	90-110
4.00	120-150
5.00	160-180
AC/DC(+)	

SHIVA - FENI

Classification : AWS A 5.15 : E Ni-Fe-CI

A medium coated graphite based electrode, depositing Ferro-Nickel type of weld metal. The weld metal has good ductility and adequate strength with easy machinability. uniform and defect free weld deposit with easily detachable slag and operates extremely well on AC as well as DC(+). Suitable for joining, repairing, filling and reclaiming of various cast iron parts, as well as for joining cast iron to steels, hot & cold welding on CI parts, gray cast iron, modular graphite iron, malleable iron subject to heavy wear. The electrode is suitable for welding cast iron without preheat.

Weld Metal Properties

C%	:	0.80 - 1.50
Si%	:	0.90 max
Ni%	:	50.0 - 60.0
Fe%	:	Balance
UTS	:	300 - 400 Mpa
Hardness	:	175 - 200 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	40-70
3.15	70-100
4.00	90-120
5.00	140-180
AC/DC(+)	

SHIVA Ni - CAST

Codification : AWS A 5.15 : E Ni - Cl

A Graphite based electrode, depositing pure nickel type of weld metal for cold welding of cast iron such as gray cast iron, malleable cast iron etc. The weld metal has good ductility and is easily machinable and has resistance to corrosion. The arc is stable even at low current ranges, and this minimises dilution of weld metal with harmful elements present in the parent metal. Suitable for reclamation of castings and machine parts, Filling-in blow holes in casting, It is ideally suited for sound, crack free welds on gray cast iron, S. G. iron, malleable iron and for joining cast irons to steels and to nickel-copper alloys. The electrode is suitable for welding cast iron without preheat.

Weld Metal Properties

Mn%	:	1.00 - 2.00
Si%	:	0.50 max
Ni%	:	92.0 - 96.0
Fe%	:	Balance
UTS	:	320 - 450 Mpa
Hardness	:	150 - 180 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	45-65
3.15	70-90
4.00	100-120
5.00	140-160

AC/DC(+)

ELECTRODES FOR METAL CUTTING & GOUGING

SHIVA - CUT

A medium coated electrode specially designed for faster and smoother cutting, piercing and bevelling of all kind of ferrous and non ferrous alloys, medium & high alloy steels, cast iron stainless steels etc. The exothermic coating withstands high amperage without overheating. A forceful arc makes it possible to cut all metals and alloys without providing supplementary gases, compressed air or oxygen or special torches. The electrode is easy to operate in all cutting positions where gas cutting is not convenient. Suitable for cutting all types of steels.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	130-180
3.15	150-230
4.00	200-300
5.00	250-350

RECOMMENDED PROCEDURE FOR CUTTING :

For cutting thicker plates, use DC current. After striking arc hold electrode at 40 to 45 degrees to the plate. keep Sawing motion till cut is finished. For faster and smoother cut, maintain the arc closer to the work piece. for cutting thinner sheets, hold electrode straight at 90 degrees. For grooving and piercing, hold electrode straight 90 degrees. strike the arc and push in and out till grooving or piercing is finished.

AC / DC(-)
OCV 50V

SHIVA - CHAMFER

A heavy coated specially designed electrode for chamfering, gouging and making grooves in all metals. The special coating of the electrode produces a strong gas jet that blows away the melted material and prevents the electrode from over heating at high amperages. The force of the arc blows away unwanted or fatigue material from its path leaving a clean groove. It produces hot exothermic penetrating arc with high blowing effect. Suitable for beveling cracks, removing, flashers & risers on foundry casting & removal of unwanted sections & excess metal. The special advantage of SHIVA-CHAMFER is the accessibility in locations where it is inconvenient to work with metal cutting tools or even gas cutting torch, It is handy electrode wherever repair or maintenance welding is envisaged such as in foundries, Fabrication industries, steel plants, cement plants, mines etc.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	150-200
3.15	200-250
4.00	250-350
5.00	350-400

AC / DC(+)
OCV 50V

RECOMMENDED PROCEDURE FOR GOUGING

For better gouging strike the arc holding electrode straight, then incline the electrode at 20-25 degrees to the work piece. keep the arc pointing towards the direction of travel, then move electrode in forward and backward direction repeatedly. The forceful arc with blow the molten metal away.

LOW HEAT INPUT ELECTRODES

Introduction to Maintenance & Repair Welding

Why Reclamation:-

In our endeavor for higher productivity which requires new machines, new materials and new processes. We have neglected the enormous waste generated by the "Throw away" attitude originated from small and less expensive items like hand tools but later expended to large and more expensive items. The components like valve, Shafts, Pumps, Gears and Housings are being discarded and written off. This has resulted in increasing heap of scarps. The need for new supplies intensifies search for new mineral resources.

We can not take unlimited mineral resources on earth for granted. Discretion must be used to utilize these assets more efficiently by prolonging their life. The replacement of costly parts in industry must give way to their reclamation. The attitude of "Throw away" must be replaced by an approach of recycling through reclamation maintenance and repair welding has proved its role very significantly in this respect.

Need For Cost Reduction:-

Industries in developed countries are always eager to find out new methods of cost reduction. A Scientific implementation of maintenance and repair welding has great potential in reducing costs in any industry, when ever a machine part is broken or worm out, instead of throwing it away, it should be reclaimed in a scientific manner to obtain longer working life. After proper diagnosis of the reason of failure and study of working conditions. Shiva SA- Series electrodes should be used for reclamation with proper procedure.

Shiva SA-Series:-

Each Electrode in the Shiva-SA-Series is designed to provide maximum life to complex machinery part subjected to serve operating, conditions. Shiva SA- Series covers all your welding applications, Steel Components, crushing or grinding applications, abrasive/ erosive areas, metal to metal wear, elimination of distortion in sheet metal components or welding of difficult steels. With Shiva-SA-Series Electrodes you can obtain defect free/ Optimum life of weld deposition in all such applications.

How to Select From Shiva-SA-Series:-

Each Shiva-SA-Series Electrode has been designed to fulfill a Specific need. Our well trained application engineer (only a phone call away) will assist you in selecting the right product. We have a wide network of qualified application engineers posted at strategic locations all over the country to render you the best of services, backed up by efficient distribution system to ensure that you get the right product at the time you need it most. Our application engineers shall be pleased to help you arrive at the step by step welding techniques to achieve optimum results.

LOW HEAT ELECTRODES FOR CARBON STEEL

SHIVA- SA-1A

A Specially designed low heat input touch electrode for welding in all position. Self detachable slag and finally rippled weld deposit are special features. Specially recommended for thin gauge sheets and plates, where warpage, distortion and stresses are to be kept minimum. Weld metal is smooth, uniform and of radiographic quality.

Applications : Ducts, Bus bodies, tanks, Pipelines, Furniture, Chassis, Air Conditioning Unit & Machine Guards.

Procedure : Machine / grind to remove fatigued metal Hold electrode at right angle in the direction of travel. Do not weave during contact welding. Avoid arc gap where distortion and positional welding are important. slag is self releasing.

Typical Weld Metal Mech. Properties

UTS : 490 Mpa
Elg % : 26

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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2.50	60-80
3.15	80-110
4.00	110-160
5.00	140-200

AC/DC(±)

SHIVA-SA-1B

A basic coated, extra low hydrogen, low heat input electrode designed for Radiographic quality welds on mild steel, medium carbon and low alloy high strength steels. Deposits exhibit very high strength and provide unique resistance to hydrogen induced embrittlement. Also designed for buffer layer under hard facing deposits.

Applications : Pressure Vessels, Heavy earthmoving equipments, Flanges, Crane Jibs, Crane, Booms, Automobile chassis, High pressure piping, Gears & sprockets and steel casting defects.

Procedure : Clean weld area to remove surface contamination and gouge/grind all cracks. Maintain a short arc. Preheat is usually not needed unless very heavy sections are involved.

Typical Weld Metal Mech. Properties

UTS : 560 Mpa
Elg % : 28

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 60-80
3.15 90-120
4.00 120-160
5.00 150-200

AC/DC(±)

SHIVA-SA-1C

A low heat input electrode for radiographic quality welds on low alloy steels such as Si-Mn Steels with non hydrosopic flux coating provides excellent crack resistant & toughness at sub zero temperatures. Suitable for heavy sections & restraint joints subjected to dynamic loading

Applications : Bogies, Boiler Tubes, Heat Exchangers, Column, Rams & Hammer Bases. The restrained joints in heavy sections and joints subjected to dynamic loading.

Procedure : Clean weld area of any surface contamination. Use a short arc for horizontal fillets. Contact technique may be used. For vertical joints use rapid weaving and start welding from bottom. For welding heavy sections in cast steel preheating may prove beneficial.

Typical Weld Metal Mech. Properties

UTS : 560 Mpa
Elg % : 27

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 60-80
3.15 90-120
4.00 120-150
5.00 150-200

AC/DC(±)

LOW HEAT INPUT ELECTRODES FOR STAINLESS STEELS

SHIVA-SA-2A

A low heat input all purpose Electrode with high corrosion and heat resistance for welding of stainless steel types AISI 304, 304L, 321 and 347. Specially recommended for joining extra low carbon grades to minimize carbide precipitation and eliminate inter-granular corrosion. Excellent resistance to impact heat and scaling. Weld metal is of radiographic quality.

Applications : Food Processing equipment, Distillery equipments, Kitchen equipments, Chemical Industry, Breweries & Dairy Equipment.

Procedure : Clean weld area of oil, Grease and dirt. Thickness up to 10 gauge can be square butt welded. Heavier sections should be beveled to 60° angle. Hold electrode at a 15° angle in the direction of travel. Maintain very short arc and chip slag between passes. Avoid weaving.

Typical Weld Metal Mech. Properties

UTS : 580 Mpa
Elg % : 35

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-90
3.15 90-110
4.00 110-140
5.00 140-180

AC/DC(±)

SHIVA-SA-2B

All purpose low heat input electrode with high corrosion and heat resistance up to 300°C for smooth and heat rapid metal deposition. Suitable for welding of Cr, Ni, Mo Steels of type 316, 316L, 318 and other Mo bearing stainless Steel. Also recommended for joining extra low carbon grades to reduce carbides precipitation and eliminate intergranular corrosion. Excellent resistance to input corrosion, heat and scaling.

Applications : Bogies (both cast & fabricated), Hammer Bases, Columns Rams, Low alloy steels such as Si-Mn Steels, Restrained joints in heavy sections & Joints subjected to dynamic loading.

Procedure : Clean weld area. Bevel heavy section to 60° Vee thickens up to 2 mm can be square but welded, For long seams, tack at short intervals. Use suitable clamps to minimize warping. Keeping a short arc, deposit stringer beads.

Typical Weld Metal Mech. Properties

UTS : 580 Mpa
Elg % : 35

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-80
3.15 80-110
4.00 110-140
5.00 140-180

AC/DC(+)

SHIVA-SA-2C

A low heat input Electrode which is ideal for Welding of Stainless Steels of unknown Chemical composition. Suitable for applications requiring high Oxidation resistance and high Strength at temperatures up to 1100°C. Also used for joining Stainless Steel to mild Steel.

Applications : Heat treatment Boxes, Furnace Pots, Valves, Shaft, Alloys Steel Pumps, Kiln Cooler plates, Reaction Vessels & Tanks etc.

Procedure : Clean weld area of any surface contamination. Tack weld at short intervals, if jigs/ Clamps are not available. Thickness up to 2 mm should be square but welded. Above 2mm sections should be beveled to 60°. Maintain short arc and chip slag between passes.

Typical Weld Metal Mech. Properties

UTS : 600 Mpa
Elg % : 35

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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2.50	50-70
3.15	80-100
4.00	110-140
5.00	140-180

AC/DC(+)

SHIVA-SA-2D

A Versatile Electrode for welding most types of stainless steels, high alloy steel and Special Steels. Deposits have high Cr-Ni contents for welding Straight Chrome Steels. The high strength deposits have excellent resistance to corrosion and heat up to 1200°C.

Applications : Foundry Defects, Pump housing Rotors Compressors, Drum Valves, Shafts, Hot Dies Rolls, Joining Unknown Stainless Steels Heat Exchangers, Furnace parts, Gas turbines & Dip tube.

Procedure : Clean weld area heavy section should be beveled to 60°. A short arc should be maintained and stringer beads be deposited. Peering must be carried out on crack sensitive applications.

Typical Weld Metal Mech. Properties

UTS : 650 Mpa
Elg % : 35

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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2.50	60-80
3.15	80-120
4.00	120-150
5.00	150-180

AC/DC(+)

SHIVA-SA-2E

A highly alloyed, versatile, low heat input Electrode for joining difficult to weld steels e.g. high carbon harden-able tools, die and spring steels, manganese Steel, free cutting Steels, high temperature Steels. Also recommended for joining unknown and dissimilar Steels. Deposits are tough, wear resistance and have very high tensile strength with superior crack resistance.

Applications : Tools, Dies, Gears, Pinions, Springs, Shafts, Dissimilar steels, Leaf springs, Wear plates, Gear box and Earth moving equipment.

Procedure : Gouge /grind cracks, damaged and fatigued metal. Bevel heavy sections 90°. Use skip, staggered welding sequence. Peen deposits while hot. Preheat is usually not necessary unless very heavy sections are involved.

Typical Weld Metal Mech. Properties

UTS : 830 Mpa
Elg % : 25

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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Hardness: 200-220 BHN	2.50 50-70
	3.15 70-100
	4.00 100-140
	5.00 140-180

AC/DC(+)

SHIVA-SA-2F

A versatile electrode for Welding of Manganese and joining it to mild steel. Can also be used as buffer layers under hard facing deposits. The weld metals gives good hardness in as deposited condition and work hardens, rapidly in service.

Applications : Crusher hammers, Railway points & crossings, Conveyor rolls, Track pads & rollers, Sprocket wheels, Crusher rolls, Crusher jaws, Buckets etc.

Procedure : Gouge /grind cracks, damaged and fatigued metal. Use Skip and staggered Welding Sequence. On manganese Steel, do not allow base metal temperature to go beyond 150°C.

Typical Weld Metal Mech. Properties

UTS : 635 Mpa
Elg % : 36

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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Hardness: As deposited 170 BHN	3.15 90-110
	4.00 120-150
	5.00 160-190
Work Hardened up to 450 BHN	

AC/DC(+)

LOW HEAT INPUT ELECTRODES FOR HARD FACING

SHIVA-SA-3A

A low heat input electrode which deposits protective coating to resist severe impact on ferrous parts subject to heavy shock loading & pounding in service. The deposit is strong, tough & has high resistance to friction & impact. Deposits are fully machinable.

Applications : Excavator parts, Dredgers, Crane wheel Wobblers, Hammers, Sprockets, Rollers, Gears, Mixer bladders, Idlers, Chassis, Concrete mixer blades etc.

Procedure : Clean weld area of any surface contamination. Use of Shiva-SA-6B is recommended to remove fatigued metal. Heavy sections may be preheated to about 120°C -150°C Holding a short to medium arc, stringer or weaving technique can be used. Long deposits may be made but do not allow excessive heat build up. Remove slag between passes. Allow slow cooling

Mechanical Properties

Hardness :
As deposited
275-325 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	90-110
4.00	120-150
5.00	150-190

AC/DC(+)

SHIVA-SA-3B

A low heat input super alloy for overlaying on parts subjected to abrasive wear and impact. Recommended for multipass build up on steels, manganese steel and malleable iron. Excellent arc stability and beads are smooth, uniform and of good appearance. Weld metal is machinable with carbide tools.

Applications : Excavating equipment, Cold punching Dies, Plough Shares, Forging dies, Wobblers & Brake shoes.

Procedure : Remove damaged / fatigued metal using gouging electrode Preheating of heavy Sections to about 230°C is recommended Stringer or weaving technique may be used holding a short to medium arc. Do not allow excessive heat build-up. Chip slag between passes. Allow to cool slowly.

Mechanical Properties

Hardness :
As deposited
350 - 400 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	90-110
4.00	120-150
5.00	150-190

AC/DC(+)

SHIVA-SA-3C

A Specially formulated low heat input Electrode depositing air hardening type weld deposit for protective coating on parts subjected to abrasive wear accompanied with some impact. The deposit is tough, dense & porosity free.

Applications : Shovels, Plough Shares, Jaw Crushers, Buckets, Crusher hammers, Scrappers, Excavating equipments & Impellers.

Procedure : Clean weld area and sear away fatigued metal using Shiva-SA-6B. Preheat heavy Sections to 200°C - 240°C. Use stringer or weaving technique keeping short to medium arc length long deposits can be made without any change of cracking. Do not allow base metal to be overheated remove slag between passes and allow to cool.

Mechanical Properties

Hardness :
As deposited
600 - 680 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	90-120
4.00	120-150
5.00	150-190

AC/DC(+)

SHIVA-SA-3D

A highly alloy low heat input electrode depositing Chromium carbide type weld deposit, superior weldability & compressive strength. The Specially formulated flux coating helps in fast & uniform depositing rate.

Applications : Conveyor, Auger screws, Crushers, Scraper blades, Bucket lips, Mill hammers, Cement grinder rings, Road rippers, Coal chutes & Fan blades.

Procedure : Clean weld area. Use Shiva-SA-6B for removing fatigued metal from the surface. Preheat alloy steels and cast iron to 100°C. The electrode may either be used on AC or DC reverse polarity. Maintain a medium arc.

Mechanical Properties

Hardness :
As deposited
650 - 730 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	80-110
4.00	100-140
5.00	140-180

AC/DC(+)

SHIVA- SA-3E

A highly alloy low heat input super alloy depositing a weld metal extremely rich in chromium carbides. For use where a combination of hardness and toughness is desired on carbon and alloy Steels, Manganese steels and cast irons. The deposit resists scaling and retains at elevated temperature up to 510°C for applications where erosion, abrasion and impact are to be resisted.

Applications : Conveyor screws, Sand pump casting, Boring tools, Pug mill knife, Tube mill and rolling mill guides, Paddies, Wear pads, Dozer blades & I.D. fans.

Procedure : Clean metal surface of any combination. Use Shiva-SA-6B to remove damaged metal. Slight heat is recommended for alloy steels and cast iron. Keeping a medium arc, maintain an angle of 45° in direction of weld. Do not use more than two layers of Shiva-SA-3E at a time, while surfacing medium and high carbon steels. Use Shiva-SA-1B for buffer layer to avoid chances of cracking.

Weld Metal Mech. Properties

Hardness :
As deposited
550 - 650 BHN

Depositing
Rate 180%

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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3.15	100-130
4.00	130-170
5.00	160-200

AC/DC(+)

SHIVA- SA-3F

For extremely ductile and non-Cracking welds on austenitic manganese steels. A ferrous base Electrode with additions of nickel, manganese and some other alloying elements to improve weld ability. Recommended on carbon / alloy steel as cushion layer prior to hard facing.

Applications : Crushing hammers, Mantles, Bulldozer blades, Railways points & crossing, Austenitic manganese Steel Parts, Wear plates, Sprockets, Bucket repairs, Crusher rollers & Shovel track pads.

Procedure : Gouge out /Grind worn fatigued metal. Apply short, stringer beads. Use skip and staggered bead technique. Do not preheat manganese steel. Maintain interpass temperature below 150°C. Cool slowly.

Weld Metal Mech. Properties

Hardness :
As deposited
190 - 210 BHN

Work Hardness
up to 500 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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3.15	80-110
4.00	100-140
5.00	140-180

AC/DC(+)

SHIVA- SA-3G

A special purpose low heat input super alloy depositing weld metal having excellent resistance to deformation at high temperatures. The deposit is machinable with carbide tools. Suitable for surfacing of hot forging dies and repairing of hot working tools.

Applications : Drop forging Dies & Punches and Inserts.

Procedure : Remove all cracked or fatigued metal by Shiva-SA-6B. Clear the area to be welded thoroughly. Preheat the job up to 350°C to 400°C. Keeping short arc gap, deposit with the electrode perpendicular to welding direction. Penning must be carried out after welding. An interpass temperature of 350°C to 400°C must be maintained. After completion of welding, air cool the job to 200°C to get uniform hardness and transfer it to a furnace at 500°C-600°C and temper for 12-15 hrs. Remove the job in still air and cool.

Weld Metal Mech. Properties

Hardness :
As deposited
350 - 400 BHN

Recommended Current Ranges

Size (MM)	Current Range (Amps)
--------------	-------------------------

3.15	90-130
4.00	120-160
5.00	150-190

AC/DC(+)

SHIVA- SA-3H

An electrode with special formulation that gives an alloy containing special constituents with very high as deposited hardness and very high hardness at elevated temperatures. Suitable for parts subjected to wear due to abrasion & erosion at elevated temperatures. The deposit consists of high percentage of special constituents which retain abrasion resisting up to 650°C.

Applications : Coal burner nozzles & nozzle tips, I.ID, Fans blades, Coal burner pipes, Hot slag conveyor Clinker conveyor chains, Sinter handing equipment, Coke pusher shoes, Slurry pumps & Billet conveyor guide.

Procedure : Gouge out /Grind damaged and fatigued metal and clean weld area. Use stringer bead technique with short arc. For higher carbon Steels, preheat up to 250°C Use Shiva-SA-2E as Cushion alloy if more build up is required. For austenitic manganese steels do not allow temperature of parts to rise more than 150°C. Slow cool after welding.

Weld Metal Mech. Properties

Hardness :
As deposited
64-67 RC at 400°C
59-62 RC at 500°C
57-58 RC at 600°C

Recommended Current Ranges

Size (MM)	Current Range (Amps)
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3.15	90-120
4.00	120-160
5.00	150-190

AC/DC(+)

LOW HEAT INPUT ELECTRODES FOR CAST IRON

SHIVA-SA-4A

An economical low heat input electrode for all cast iron repair applications not requiring machining. The weld metal will oxidize & match its colour with cast iron. Specially designed to seal contaminated surfaces in old, dirty, oily, greasy cast irons.

Applications : Sealing oil soaked cast iron foundry defects, Motor and valve bodies, Guards on Machine tools, Machine framers, Oxidized cast iron furnace equipment & Pump impellers.

Procedure : Clean weld area. Drill holes at ends of the crack. Chamfer the cracks with Shiva-SA-6B Short to medium arc gap can be kept to suit the section but arc should be directed on deposited metal. Do not weave. Weld only up to 7 cms long beads. Back whip the crater.

Mechanical Properties

UTS :
370 - 490 Mpa

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-70
3.15 80-110
4.00 110-140
5.00 150-180

AC/DC(-)

SHIVA-SA-4B

A low heat input nickel alloy machinable electrode for optimum penetration on contaminated surfaces of nodular (SG Iron), malleable, grey cast iron and joining to steel. Deposits are fully machinable. Electrode has exceptional crack sensitivity. Use on both heavy and thin sections.

Applications : Pump housings, Rotors, Foundry defects, Compressors, Bearing Blocks, Rope drums, Valves, Gear boxes, Sprocket wheels, Machine beds & Motor covers.

Procedure : Use Shiva-SA-6B to Chamfer out the cracks. Deposit short, stringer beads with short arc. Peen the weld deposit while hot. Do not allow excessive heat build up in base metal. Remove slag between passes. Casting should be covered and allowed to cool slowly.

Mechanical Properties

UTS :
340 - 440 Mpa

Hardness :
As deposited
180 - 200 BHN

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-70
3.15 80-100
4.00 110-140
5.00 140-180

AC/DC(+)

SHIVA-SA-4C

A special low heat input super alloy suitable for joining and repair of grey and malleable cast irons and dissimilar joints between these and steel, monel and stainless steels. Best suited for cladding, repairing cracks and joining of C.I. to other metal. Exceptionally good for vertical and overhead welding.

Applications : Engine blocks (water jackets), Pump housing, Cylinder blocks, Cast Iron gears & pulleys, Machine beds, Glass moulds & Impellers.

Procedure : Clean weld area of all scale, grease and dirt. Use Shiva-SA-6B to chamfer out the crack. Preheat of 200°C is recommended to obtain maximum machinability. In case of highly contaminated cast iron surface, apply a buffer layer of Shiva-SA-4A. Deposit short stringer beads, maintaining short arc. Peen to relieve stresses. Remove slag between passes. Allow slow cooling.

Mechanical Properties

UTS :
340 - 440 Mpa

Hardness :
As deposited
180 BHN

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-70
3.15 70-110
4.00 90-130
5.00 130-160

AC/DC(+)

SHIVA-SA-4D

A specially formulated low heat electrode for welding of grey, malleable & nodular cast iron. Special features are exceptional crack resistivity, all position weld ability of excellent machinability cast iron with unknown composition can also be welded. The electrode gives an extremely shallow and yet sufficient depth of fusion which ensures minimum dilution of the weld metal by the base metal. The deposit has good colour match with parent metal.

Applications : Pump rotors & housings, Machining errors in castings, Compressors, Valves & Gear boxes.

Procedure : Gouge out cracks with Shiva-SA-6B after drilling holes at the ends of the cracks. Clean weld area. Deposit short, stringer beads, maintaining a short arc. Peen deposits while hot. Remove slag between passes.

Mechanical Properties

UTS :
340 - 440 Mpa

Hardness :
As deposited
180 BHN

Recommended Current Ranges

Size Current Range
(MM) (Amps)

2.50 50-80
3.15 80-110
4.00 110-130
5.00 130-170

AC/DC(+)

LOW HEAT INPUT ELECTRODES FOR BRONZE

SHIVA- SA-5A

An exceptional bronze alloy electrode having excellent weldability. The electrode gives dense porosity free deposits which are fully machinable and colour matching to bronze versatile electrode for joining and overlying of steels cast iron and bronze etc. The deposits are easily machinable to a smooth surface with low coefficient of friction. Deposit resists salt water and steam corrosion.

Applications : Pump casting, Impellers, Marine Components & gear teeth, Packing glands, Sleeves, Bearing surfaces, Bus bar, Casting Salvage & Dissimilar metals.

Procedure : Clean weld area of any contamination. Bevel the edges. Heavy sections should be preheated to 150°C - 300°C. Maintain short arc at lowest amperage and deposit stringer beads. Remove slag between passes. Do not allow the job to get over heated.

Weld Metal Mech. Properties

UTS :

290 Mpa

Hardness :

As deposited

75 - 80 RB

Work hardened

90 - 95 RB

Recommended Current Ranges

Size (MM)	Current Range (Amps)
2.50	40-70
3.15	70-100
4.00	100-140
5.00	140-180

AC/DC(+)

LOW HEAT INPUT ELECTRODES FOR CUTTING & GOUGING

SHIVA- SA-6A

An electrode for cutting & piercing of various grades of steels, cast iron, malleable iron, nickel & nickel alloys, stainless steel, aluminum, copper, bronze etc. Slow burn off rate leaves little residue requiring very little finishing Shiva-SA-6A can with stand high current without overheating.

Applications : Cleaning out defects, Piercing holes, Burning rivets, Cutting of plates and pipes, Flash and risers.

Procedure : Mark the line of desired cut. Use AC or DC straight polarity when using Shiva-SA-6A for cutting. When arc is struck, use sawing motion holding electrode at 45°C angle. For piercing holes, the electrode should be held vertically and pushed in and out.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	150-200
4.00	200-240
5.00	280-320

AC/DC(-)

SHIVA- SA-6B

A special purpose electrode producing hot exothermic, penetrating arc for chamfering, grooving or gouging operations with out any supplementary equipment on all ferrous and non ferrous metals. Ideal to remove most unwanted metal prior to final machining.

Applications : Gouging Aluminum, Cast iron & other metals, Beveling cracks, Preparing sections prior to welding, Removing flashers and risers in foundry castings and Back Gouging of buff joints before depositing sealing pass.

Procedure : Hold electrode pointing in the direction of travel at an angle up to 30° with the plane of work. Use AC or DC straight polarity. After striking arc push electrode along the line of cut. Move quickly for shallow chamfer, slowly for deeper groove push the molten metal away making use of the force and head of concentrated arc. Repeat the procedure for deeper groove.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	150-200
4.00	250-300
5.00	300-350

AC/DC(-)

LOW HEAT INPUT ELECTRODES FOR SPECIAL APPLICATION

SHIVA- SA-70

A low heat input, graphite base super alloy that gives weld metal deposit of chromium carbide and complex carbide without any micro cracks. Product designed in a way to produce soft arc and minimum spatter loss. Deposit is highly resistant to friction wear. Used for surfacing of manganese steel, malleable iron etc.

Applications : Road rippers, Plough shares, Coal chutes, Oil expellers, Cement grinder ring s& Screw conveyor.

Procedure : Gouge out/ grind fatigued or damaged parts. On high carbon steel, preheat the parts if necessary deposit the alloy directly on base metal. On manganese steel preheat is not necessary and before hard deposit provide buffer layer with Shiva-SA-3F and hard surface with Shiva-SA-70.

Weld Metal Mech. Properties

Hardness :

58 - 63 RC

Recommended Current Ranges

Size (MM)	Current Range (Amps)
3.15	100-120
4.00	120-140
5.00	140-180

AC/DC(+)

SHIVA-SA-7A

For rebuilding of worn out components which are used for handling hot metal or work under high temperature conditions. Deposits have unmatched resistance to corrosion due to oxidizing acids, salts, chlorine bearing compounds and mixed acids etc., even at elevated temperatures. Recommended for joining and build up of Hast-alloys, In cores and Illiums. Also recommended for joining these high alloys to mild steels, low alloy steels or stainless steels.

Applications : Die stamps, Vats, Pumps, Acid pipe lines, Pickling/Plating tanks, Hot forging components, Hot shear blades & Hot trimming dies.

Procedure : Remove damaged or fatigued metal using gouging electrode. Preheat is usually not necessary unless heavy sections are involved when surfacing and cladding both stringer bead and weaving techniques may be employed. When fabricating high alloys, stringer beading is preferred. Hold a short arc and back whip craters. Remove slag.

Typical Weld Metal Mech. Properties

UTS : 70 Mpa

Elg % : 28

Metal Recovery :

up to 150%

Hardness :

As deposited

20 - 24 RC

Work hardened

up to 48 RC

Recommended Current Ranges

Size (MM)	Current Range (Amps)
-----------	----------------------

3.15	70-100
------	--------

4.00	120-150
------	---------

AC/DC(+)

SHIVA-SA-7B

A low heat input alloy for joining and building up all steels, including heat treatable types, difficult to weld types and those with unknown compositions. Suitable for nickel alloys and their dissimilar combination. It gives excellent weldability without overheating of electrodes, tough and porosity free deposits.

Applications : Heat treatment equipments such as Retorts, Rocks, Guide shoes, Mantle bars, Rotary Kiln tyres, Joining of dissimilar steels, Cryogenic equipment & Earth moving equipment.

Procedure : Clean the weld area of any surface contamination. Sear away fatigued metal using Shiva-SA-6B. Bevels are to be prepared for heavy sections. Preheating is recommended only for materials prone to cold cracking. Use stringer beads with short arc and lower range of current. Peen the weld metal and allow cooling at slow rate.

Typical Weld Metal Mech. Properties

UTS : 60 Mpa

Elg % : 32

Recommended Current Ranges

Size (MM)	Current Range (Amps)
-----------	----------------------

2.50	70-90
------	-------

3.15	100-120
------	---------

4.00	120-150
------	---------

AC/DC(+)

SHIVA-SA-80

A special purpose high recovery electrode for the sugar industries to deposit hard droplets on tooth points of cane crusher rollers. It deposits a high alloy chromium carbide weld metal in globular form. These hard globules increase the effective surface resulting in lower level of moisture in bagasse. The deposit of Shiva SA 80 shall gradually wear out during crushing season but the rolls are protected without any change in diameter. The life of roughening deposit varies from mill to depending up to the quality of fable contents preset in cane. However the process to replenish the roughening of feed rolls with Shiva SA 80 can be carried out in wet conditions without any stoppage of the mill there by avoiding downtime and production losses.

Applications : Specially designed for arcing of cast iron and cast steel sugar mill crusher rollers. Excellent weldability for 'wet' and 'dry'.

Procedure : Set lowest possible welding current with in the range. Use Shiva SA 80 with crushing roll in operation at a speed of 4 - 8 RPM Deposit on the side walls of the grooves, maintaining the electrode in contact with the roll, keep the electrode inclined about 30° below the horizontal line and in the direction of the movement of the roll. Deposits leave little or no slag.

Recommended Current Ranges

Size (MM)	Current Range (Amps)
-----------	----------------------

4.00	140-180
------	---------

AC/DC(+)

Typical Weld Metal Mech. Properties

Hardness :

58 - 60 RC

SHIVA-SA-90

A low heat input, graphite base super alloy deposits chromium carbide and complex carbide without micro cracks. Deposits is very rich in carbides to give enhanced service life. Deposits display very high wear resistance property makes the product versatile in application. Soft arc and low spatter gives smooth deposits.

Applications : Coal chutes, Scrapers, Plough share, Screw conveyors, Oil expellers, Buckets & Cement grinder rings.

Procedure : Gouge out/grind fatigued or damaged parts on high carbon steel, preheat the parts if necessary, deposit the alloy directly on base metal. On manganese steel preheat is not necessary and before hard deposit provide a buffering layer with Shiva SA 3F.

Typical Weld Metal Mech. Properties

Hardness :

58 - 63 RC

Recommended Current Ranges

Size (MM)	Current Range (Amps)
-----------	----------------------

3.15	100-120
------	---------

4.00	120-140
------	---------

5.00	140-180
------	---------

AC/DC(+)

MIG / MAG FILLER WIRE

SHIVA- CO₂

CLASSIFICATION : AWS: A/SFA 5.18: ER 70 S-6, IS : S4- C 504

CHARACTERISTICS : A Copper coated MIG wire for MIG/MAG welding of carbon steels, uniform copper coating, smooth feeding, stable arc and minimum spatter under optimum welding conditions, normally recommended with CO₂ shielding, can be used with Ar- CO₂ mixtures also, resulting improved mechanical properties in well deposit.

APPLICATIONS : Wide applications in automotive industry, construction and mining equipment, railway wagons, and coaches, etc. also suitable for welding pipe, pressure vessels, LPG cylinders and structural steel components.

CHEMICAL ANALYSIS :

C %	Mn %	Si %	S %	P %	Cu %	Ni %	Cr %	V %
0.06 - 0.15	1.40 - 1.85	0.80 - 1.15	0.035 max	0.025 max	0.50 max	-	-	-

MECHANICAL PROPERTIES :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (%)	CVN Impact Energy at -30°C (Joules)	Radiographic Test
400 Min.	480 Min.	22 Min.	27.0 Min.	Satisfactory

CURRENT CONDITION : Shielding Gas CO₂, / CO₂80% + Ar 20% Current Condition: DC (+)

Size (mm)	0.80	1.00	1.20
Current Range (Amps)	160 - 200	200 - 240	250 - 290

MIG LOW ALLOYS WIRE

SHIVA MIG 80S

CLASSIFICATION: AWS A/SFA 5.28: ER 80SG

CHARACTERISTICS : A Copper coated MIG wire for MIG/MAG welding of high tensile steels. Uniform copper coating, smooth feeding, stable arc and minimum spatter under optimum welding conditions, Normally recommended with Ar / O₂ shielding. CO₂ shielding may also be used, with note of properties as given below.

APPLICATIONS : Widely used for the welding of high tensile steels like IS 2002 Gr III, IS 1875cl. IIIA. Construction and mining equipment, railway wagons, and coaches, etc. also suitable for welding pipe, pressure vessels, LPG cylinders and structural steel components.

CHEMICAL ANALYSIS :

C %	Mn %	Si %	S %	P %	Cu %	Ni %	Cr %	V %
0.07 - 0.12	0.60 - 1.20	0.40 - 0.80	0.025 max	0.025 max	0.20 - 0.40	0.80 min.	0.15 max	0.05 max

MECHANICAL PROPERTIES :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (%)	CVN Impact Energy at -46°C (Joules)	Radiographic Test
390 Min.	540 Min.	24 Min.	25 min.	Satisfactory

CURRENT CONDITION : Shielding Gas CO₂, Current Condition: DC (+)

Size (mm)	0.80	1.00	1.20
Current Range (Amps)	160 - 220	200 - 260	250 - 300

SHIVA MIG 90S

CLASSIFICATION : AWS A/SFA 5.28 : ER 90SD2

CHARACTERISTICS : A Copper coated MIG wire for MIG/MAG welding of high tensile steels. Uniform copper coating, smooth feeding, stable arc and minimum spatter under optimum welding conditions, Normally recommended with Ar / O₂ shielding. CO₂ shielding may also be used, with note of properties as given below.

APPLICATIONS : Widely used for the welding of high tensile steels like IS 8500 Grades 540 B, 570B and 590B, IS 2002 Gr III, IS 1875 Cl, IIIA. Welding of SAILMA 450/ 450H1 steel used in CONCOR wagons is a typical application for this wire.

CHEMICAL ANALYSIS :

C %	Mn %	Si %	S %	P %	Cu %	Ni %	Mo %
0.07 - 0.12	1.60 - 2.10	0.50 - 0.80	0.025 max	0.25 max	0.20 - 0.40	0.15 max	0.40 - 0.60

MECHANICAL PROPERTIES :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (%)	CVN Impact Energy at -30°C (Joules)	Radiographic Test
540 Min.	620 Min.	17 Min.	27 Min.	Satisfactory

CURRENT CONDITION : Shielding Gas Ar + 1.5% O₂, Current Condition: DC (+)

Size (mm)	0.80	1.00	1.20
Current Range (Amps)	160 - 210	200 - 250	250 - 290

SHIVA MIG 308L

CLASSIFICATION: AWS A/SFA 5.9 : ER 308L

CHARACTERISTICS : An extra low carbon 20 Cr/10Ni stainless steel filler wire for MIG welding of austenitic chromium nickel stainless steels of 18 Cr/8Ni type. The controlled ferrite content of 3% to 8% in the weld ensures excellent crack resistance. The extra low carbon content increases resistance inter granular corrosion.

APPLICATIONS : For welding of stainless steels represented by AISI types 301, 302 304 and 308 having low carbon content used in chemical and food processing industries as well as for pipes tubes and boilers.

CHEMICAL ANALYSIS :

C %	Mn %	Si %	S %	P %	Ni %	Cr %
0.03 max	1.00 - 2.50	0.30 - 0.65	0.03 max	0.03 max	9.0 - 11.0	19.5 - 22.0

MECHANICAL PROPERTIES :

UTS MPa (N/mm ²)	Elongation (%)
520 Min.	30 Min.

CURRENT CONDITION : Shielding Gas 98% Ar + 2% O₂ Gas, Current Condition: DC (+)

Size (mm)	0.80	1.00	1.20
Current Range (Amps)	140 - 180	190 - 230	220 - 260

SHIVA MIG 309

CLASSIFICATION : AWS A/SFA 5.9 : ER 309

CHARACTERISTICS : A 24 Cr 13 Ni stainless steel filler wire with ferrite content of approx 15%. The weld metal has excellent oxidation and corrosion resistance in continuous service upto 1100°C.

APPLICATIONS : For welding of stainless steels represented by AISI type 309. suitable for buffering 18/8 Cr-Ni steels.

CHEMICAL ANALYSIS :

C %	Mn %	Si %	S %	P %	Cu %	Ni %	Mo %	Cr %
0.12 max	1.00 - 2.50	0.30 - 0.65	0.03 max	0.03 max	0.50 max	12.0 - 14.0	0.75 max	23.0 - 25.0

MECHANICAL PROPERTIES :

UTS MPa (N/mm ²)	Elongation (%)
540 Min.	30 - 40

CURRENT CONDITION : Shielding Gas 98% Ar +2% O₂ Gas, Current Condition: DC (+)

Size (mm)	0.80	1.00	1.20
Current Range (Amps)	150 - 190	200 - 240	230 - 280

SHIVA FLUX CORED WIRES

SHIVA.FCW (E 71 T-1)

CODIFICATION : AWS A 5.20 E71T-1C

DESCRIPTION : Shiva.FCW is an all position Rutile flux cored wire designed for optimum performance when using CO₂ shielding. The smooth metal transfer easy deposition of vertical-up stringer beads. The slag coverage is complete and designed for easy removal. Weld metal is consistently free of inclusions and porosity for X-ray soundness. This wire is formulated to produce fewer fumes, minimal spatter.

APPLICATION : Shiva.FCW is designed for all position single and multipass welding of low and medium carbon steels. Suitable for joining steels conforming to ASTM SA-36 /SA-36M and A,B,C,D grades of Sa-283 / Sa-283M & SA-414 / Sa-414M. (PNo.1) e.g. Fabrication in chemical plant machinery structures & Steel frames in ship building, heavy bridges & towers.

WELD METAL ANALYSIS (TYPICAL VALUES UNDER CO₂ SHIELD) :

C %	Mn %	Si %	S %	P %
0.07	1.25	0.38	0.010	0.018

MECHANICAL PROPERTIES OF THE PURE WELD METAL (TYPICAL VALUES) :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (L = 4d) %	CVN Impact Energy at -20°C (Joules)
470	490 - 665	26	60

NOTE : Depending on application, the electrodes recommended can vary.
Single values shown are maximum percentages except otherwise specified.

SHIVA.FCW (E 71 T-5)

CODIFICATION : AWS A 5.20 E71T-5C

DESCRIPTION : Shiva.FCW is an all position flux cored wire having stable and smooth arc with good slag detachability using CO₂ shielding. The slag coverage is complete and easy remove. Weld metal is consistently free of inclusions and porosity for radiographic soundness. This wire is formulated to have high resistance to cracking with fewer fumes & minimal spatter.

APPLICATION : Shiva.FCW is designed for all position single and multipass welding of low and medium carbon steels. Suitable for joining steels conforming to ASTM SA-525-70 and C grades of SA-285, IS:2002-2A & 2B Is226 & DIN 17155 HIV e.g. Construction bridges, Pressure vessels & Offshore structures.

WELD METAL ANALYSIS (TYPICAL VALUES UNDER CO₂ SHIELD) :

C %	Mn %	Si %	S %	P %	Ni %
0.05	1.25	0.45	0.010	0.018	0.40

MECHANICAL PROPERTIES OF THE PURE WELD METAL (TYPICAL VALUES) :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (L = 4d) %	CVN Impact Energy at -20°C (Joules)
470	550	26	60

Copper coated continuous solid wire for submerged arc welding

SHIVA SAW (EL 8)

CLASSIFICATION : AWS A 5.17 EL 8 / F6 A2 EL 8

DESCRIPTION : EL 8 wire and flux is applicable for low & medium tensile steel. Suitable for welding of thick plate. Excellent mechanical properties with radiographic quality weld, when the wire is used with Shiva flux grade F6 A2 EL 8. Suitable for single or multilayer welding of heavy duty structures.

SOLID WIRE CHEMICAL COMPOSITION :

C %	Mn %	Si %	S %	P %	Cu %
0.10 max	0.25 - 0.60	0.07 max	0.03 max	0.03 max	0.35 max

MECHANICAL PROPERTIES OF THE WELD METAL :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (%)	CVN Impact Energy at -20°C (Joules)
330	430 - 560	22 Min	27 Min

CURRENT CONDITION : DC (+)

STANDARD WIRE DIA (mm) : 2.5, 3.15, 4.0, 5.0

SHIVA SAW (EM 12 K)

CLASSIFICATION : AWS / SFA A 5.17 EM 12K / F7 A3 EM 12 K

DESCRIPTION : Butt & fillet welding of ships, building, structural steel, bridge and heavy duty structure. EM 12 K wire & flux is applicable for mild steel and high tensile steel and gives excellent mechanical properties when used Shiva flux grade F7 A3 EM 12 K.

SOLID WIRE CHEMICAL COMPOSITION :

C %	Mn %	Si %	S %	P %	Cu %
0.05 - 0.15	0.80 - 1.25	0.10 - 0.35	0.03 max	0.03 max	0.35 max

MECHANICAL PROPERTIES OF THE WELD METAL :

YS MPa (N/mm ²)	UTS MPa (N/mm ²)	Elongation (%)	CVN Impact Energy at -30°C (Joules)
400 Min	480 - 660	22 Min	27 Min

CURRENT CONDITION : DC (+)

STANDARD WIRE DIA (mm) : 2.5, 3.15, 4.0, 5.0

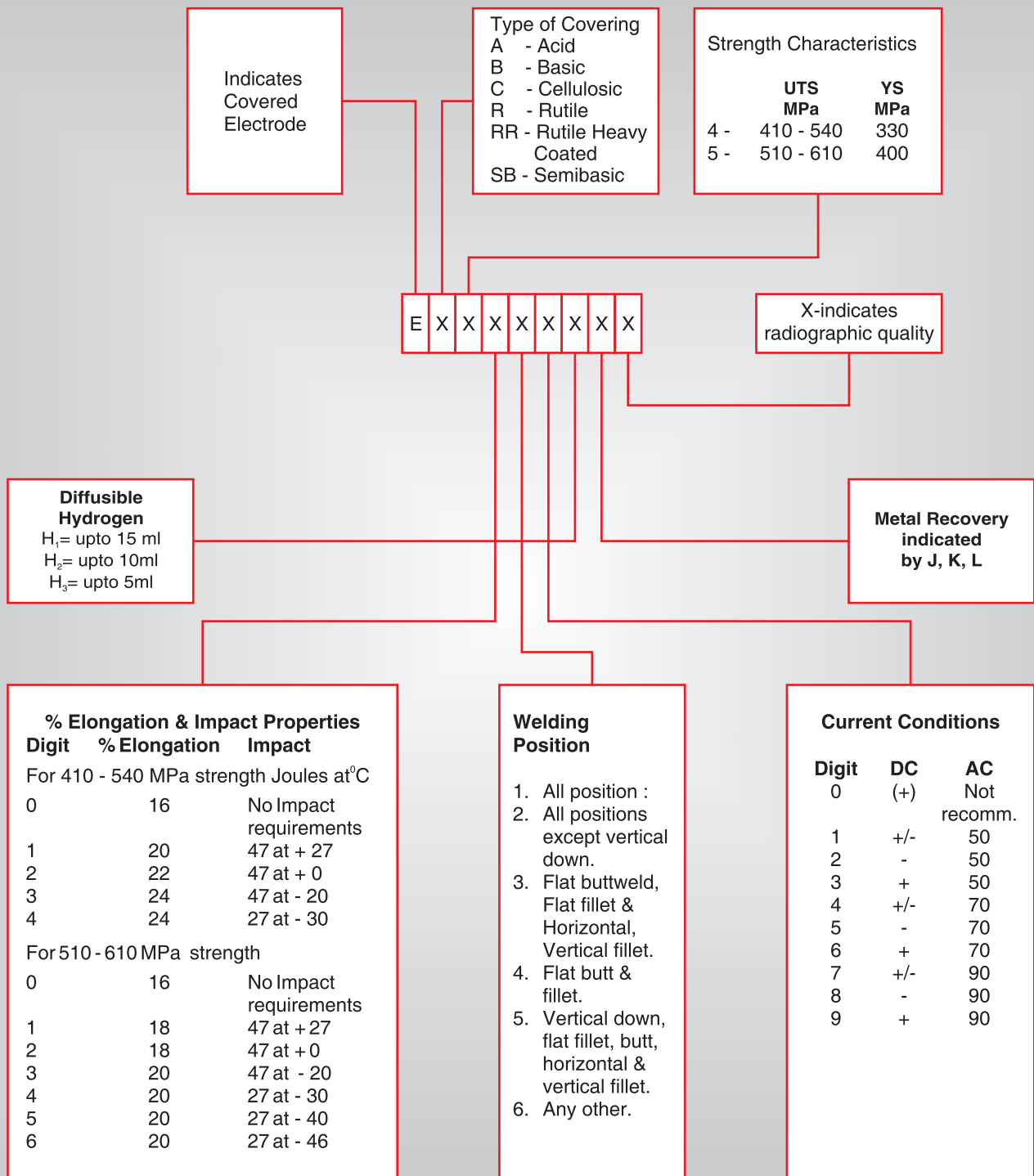
SOME COMMON AISI STAINLESS STEELS

CHEMICAL ANALYSIS (%)

AISI Type No.	C	Mn	Si	Cr	Ni	Other Elements	Recommended Electrode
201	0.15	5.5/7.5	1.0	16/18	3.50/5.50	N20.25 Max.	SHIVA- 308
202	0.15	7.5/10.0	1.0	17/19	4/6	N20.25 Max	-,,-
301	0.15	2.0	1.0	16/18	8/10	--	-,,-
302	0.15	2.0	1.0	17/19	8/10	--	-,,-
302B	0.15	2.0	2/3	17/19	8/10	--	-,,-
304	0.08	2.0	1.0	18/20	8/12	--	-,,-
304L	0.03	2.0	1.0	18/20	8/12	--	SHIVA-308-L
305	0.12	2.0	1.0	17/19	10/13	--	SHIVA-308
308	0.08	2.0	1.0	19/21	10/12	--	-,,-
309	0.20	2.0	1	22/24	12/15	--	SHIVA-309
309S	0.08	2.0	1	22/24	12/15	--	SHIVA-309
310	0.25	2.0	1.5	24/26	19/22	--	SHIVA-310
310S	0.08	2.0	1.5	24/26	19/22	--	-,,-
316	0.08	2.0	1.0	16/18	10/14	Mo 2.0/30	SHIVA-316
316L	0.03	2.0	1.0	16/18	10/14	Mo 2.0/3.0	SHIVA-316L
317	0.08	2.0	1.0	18/20	11/15	Mo 3/4	
317L	0.03	2.0	1.0	18/20	11/15	Mo 3/4	SHIVA-317-L
321	0.08	2.0	1.0	17/19	9/12	Ti5xC Min.	SHIVA-347
347	0.08	2.0	1.0	17/19	9/13	(Cb=Ta) 10xCMin.	SHIVA-347
348	0.08	2.0	1.0	17/19	9/13	(CbXTa) 10xMin.	-,,-
403	0.15	1.0	0.5	11.5/13	--	--	SHIVA-13-Cr
405	0.08	1.0	1.0	11.5/14.5	--	AlO.10/0.30	SHIVA-13-Cr
410	0.15	1.0	1.0	11.5/13.5	--	--	SHIVA-13-Cr
414	0.15	1.0	1.0	11.5/13.5	1.25/2.50	--	SHIVA-13-Cr
420	0.15	1.0	1.0	12/14	--	--	SHIVA-13-Cr
431	0.20	1.0	1.0	15/17	1.25/2.50	--	SHIVA-17-Cr
501	0.10	1.0	1.0	4/6	--	Mo0.40/0.65	SHIVA-CR-5
502	0.10	1.0	1.0	4/6	--	Mo 0.40/0.65	SHIVA-CR-5
430	0.12	1.0	1.0	14/18	--	--	SHIVA-17Cr

NOTE : Depending on application, the electrodes recommended can vary.
Single values shown are maximum percentages except otherwise specified.

THE IS - CLASSIFICATION (IS 814 - 2004)



AWS CLASSIFICATION SFA 5.1 A FOUR OR A FIVE DIGIT CODING

E	X	X	X	X	X
		X	X	X	X

INDICATES THE MINIMUM UTS OF THE UNDILUTED WELD METAL IN KSI CAN BE 60, 70, 80, 90, 100, 110 ETC.

INDICATES WELDING POSITION

INDICATES THE TYPE OF COATING AND CURRENT CONDITION

AWS Classification	Type of Covering	Welding Position	Type of Current
E 6010	High cellulose sodium	F,V,OH,H	DC (+)
E 6011	High cellulose potassium	F,V,OH, H	AC/DC (+)
E 6012	High titania sodium	F,V,OH,H	AC/DC (-)
E 6013	High titania potassium	F,V,OH,H	AC/DC (+)/DC(-)
E 6019	Iron oxide titania potassium	F,V,OH,H	AC/DC (+)/DC(-)
E 6020	High iron oxide	F,V,OH,H,H-Fillets	AC/DC (-)
E 6022	High iron oxide	F, H	AC/DC (-)
E 6027	High iron oxide iron powder	H-Fillets,F	AC/DC (-)
E 7014	Iron powder, titania	F, V, OH,H	AC/DC (+)/DC(-)
E 7015	Low hydrogen sodium	F,V,OH,H	DC (+)
E 7016	Low hydrogen potassium	F,V,OH,H	AC/DC (+)
E 7018	Low hydrogen potassium, iron powder	F,V,OH,H	AC/DC (+)
E 7018 M	Low hydrogen Iron powder	F,V,OH,H	DC (+)
E 7024	Iron powder, Titania	H-fillets, F	AC/DC (+)/DC(-)
E 7027	High iron oxide, Iron powder,	H-fillets,F	AC/DC (-)/AC/DC (+)
E 7028	Low hydrogen potassium, Iron Powder	H-fillets, F	AC/DC (+)
E 7048	Low hydrogen potassium, Iron Powder	F, OH,H, V-down	AC/DC/(+)

CONVERSION TABLE

Property	To Convert from	To	Multiply by
Area dimension (mm ²)	in ² mm ²	mm ² in ²	6.451 600x10 ⁻² 1.550 033x10 ⁻³
Current density (A/mm ²)	A/in ² A/mm ²	A/mm ² A/in ²	1.550 003x10 ⁻³ 6.451 600x10 ⁻²
Deposition rate (Kg/h)	lb/h Kg/h	Kg/h lb/h	0.45* 2.2*
Flow rate (litre per minute)	ft ³ /h	Litre per minute	4.719 475x10 ⁻¹
	gallon per hour	litre per minute	6.309 020x10 ⁻²
	gallon per minute	litre per minute	3.785 412
	cm ³ /min	litre per minute	1.000 000x10 ⁻³
	litre per minute	ft ³ /h	2.118 880
	cm ³ /min	ft ³ /h	2.118 880x10 ⁻³
Heat input (J/m)	J/in	J/m	3.937 008x10
	J/m	J/in	2.540 000x10 ⁻²
Linear measurements (mm)	in.	mm	2.540 000x10
	ft.	mm	3.048 000x10 ⁻²
	mm	in.	3.937 008x10 ⁻²
	mm	ft.	3.280 840x10 ⁻³
	psi	Pa	6.894 757x10 ⁻³
Tensile strength	lb/ft ²	Pa	4.788 026x10
	N/mm ²	Pa	1.000 000x10 ⁶
	Pa	Psi	1.450 377x10 ⁻⁴
	Pa	lt/ft ²	2.088 543x10 ⁻²
	Pa	N/mm ²	1.000 000x10 ⁻⁶
	in./min	mm/s.	4.233 333x10 ⁻¹
Travel speed, wire feed speed (mm/s)	mm/s	in./min	2.362 205
Energy	J	ft.lb.f	0.737
	J	Kfg.m	0.102

*Approximate conversion

USEFUL FORMULAE

1. Carbon Equivalent :

$$C_E = C + Mn/6 + (Cr + Mo - V)/5 + (Ni + Cu)/15$$

3. Heat input :

$$H \text{ (KJ/mm)} : \frac{V \times 1 \times 60s}{V_s \times 1000}$$

Where : V = Voltage

I = Current

V_s = Welding speed in mm/min.

2. %Delta Ferrite :

$$\%F : 3[Cr_{eq} - 0.93 Ni_{eq} - 6.7]$$

4. Preheating

$$C_c = C + \frac{Mn}{6} + \frac{Ni + Cu}{15} + \frac{Cr + Mo + V}{5}$$

$$C_t = C_c \times 0.005 \times t_{mm}$$

$$C_E = C_c + C_t$$

$$\text{Preheat temperature } ^\circ\text{C} : 350 \sqrt{C_E - 0.25}$$

HARDNESS CONVERSION TABLE

Rockwell			Vickers		Brinell	Rockwell			Vickers		Brinell
C-150 Kg Load Diamond	B-100 Kg Load 1/16" Ball		Diamond Pyramid	Tungsten Carbide Ball	Steel Ball	C-150 Kg Load Diamond	B-100 Kg Load 1/16" Ball		Diamond Pyramid	Tungsten Carbide Ball	Steel Ball
65	-		852	774	-	19	98.1		235	226	220
63	-		793	732	-	17	96.9		227	218	210
61	-		740	693	-	15	95.5		219	210	201
59	-		694	657	-	13	94.1		211	202	193
57	-		650	621	-	11	92.6		203	195	186
55	-		611	588	-	9	91.2		196	187	180
53	-		573	554	-	7	89.7		189	180	174
51	-		539	523	500	5	88.3		183	174	168
49	-		508	494	476	3	87.0		177	169	162
47	-		479	465	453	1	85.5		171	163	158
45	-		452	440	430	-	83.2		162	153	150
43	-		428	415	408	-	80.5		153	144	140
41	-		406	394	387	-	77.5		143	134	131
39	-		386	375	367	-	74.0		135	126	122
37	-		367	356	347	-	70.0		125	116	113
35	-		348	337	327	-	66.0		116	107	104
33	-		330	319	309	-	61.0		108	100	96
31	-		312	302	294	-	55.0		99	91	87
29	-		296	286	279	-	47.0		91	83	79
27	-		281	271	265	-	39.0		84	76	72
25	-		267	258	253	-	30.0		76	67	64
23	-		255	246	241	-	20.0		69	61	57
21	99.5		245	236	230		05.0		62	54	50

CONVERSION TABLE FOR CORROSION DATA

Corrosion Data Units	Conversion factors		
	g/m ² h	mm/Yr	Mils/Yr
g/m ² h	1.0	8.64/d	340/d
g/m ² /24h	0.042	0.360/d	14.2/d
g/dm ² /24h	4.17	36.0/d	1420.0/d
mg/dm ² 24h	0.004	0.036/d	1.42/d
mg/cm ² 24h	0.417	3.60/d	142/d
Lbs/ft ² /24h	203	1760/d	69200/d
Lbs/ft ² Yr.	0.564	4.88/d	192/d
mm/Yr	0.116xd	1.0	39.4
mm/month	1.39xd	12.0	473.0
um/48h	0.021xd	0.180	7.18
in/Yr	2.95xd	25.4	1000.0
in/month	35.3xd	305	12000.0
Mils/year	0.003xd	0.025	1.0
Mils/month	0.035xd	0.305	12.0

Where d = metal density
 18/8 Steel = 7.9
 Mils = inch x 10⁻³

Aluminium = 2.7
 Titanium = 4.5

STORAGE AND DRYING OF ELECTRODES

Electrodes should be kept in a dry well ventilated store under heated conditions where the humidity is below the general level. Preferably the electrodes should be stored on pallets or racks of the floor.

Due to special formulation the coating of electrodes are very resistant to moisture pick-up. Furthermore they are supplied in shrink wrapped packages which ensure protection against moisture absorption.

Electrode slightly affected by moisture should be carefully dried for minimum one hour before use as per following table.

Electrode Group	Redrying Temperature	TIME
1. SHIVA-6010	Not recommended	Not recommended
2. E-6013, E-7014, E-7024 type	100°C - 110°C	1 hr.
3. Low Hydrogen and Low Alloy Electrodes	250°C ± 10°C	2 hrs.
4. Electrodes for Hardfacing SHIVA-HF-III (LH) SHIVA-HF-V SHIVA-MANGAN	— 200°C - 250°C	1 hr.
5. Electrodes for stainless Steels	250°C - 300°C	2 hrs.
6. Non-Ferrous Electrodes	100°C	1 hr.
7. Electrodes for Cast Iron	120°C - 150°C	1 hr.
8. Electrodes for cutting & gouging	Not recommended	-

CAUSES AND REMEDIES FOR FUSION WELD DISCONTINUITIES

CAUSES	CORRECTIVE ACTION
A. POROSITY	
1. Contamination of work piece	- Clean joint area.
2. Excessive moisture pickup in electrode covering	- Store electrodes properly. Follow manufactures recommended rebaking procedure.
3. Moisture on work surfaces	- Use preheating / warm up work piece.
4. High Sulphur content of base metal	- Use basic coated electrodes.
5. a) Long arc length b) Excessive current c) Higher travel speed	- Change welding parameters and technique.
6. High solidification rate	- Use preheat. Increase heat input.
B. INCLUSIONS	
1. Improper cleaning procedure	- Clean work surfaces and each weld run thoroughly. Wherever necessary use power wire brush, grinders, chisels to ensure a thorough removal of slag.

CAUSES	CORRECTIVE ACTION
2. Improper welding technique a) Excessive weaving b) High travel speed c) Slag flooding ahead of welding arc 3. Narrow, inaccessible joints	- Improve welding technique. - Reposition work to prevent loss of slag control wherever possible. - Restrict weaving to a minimum. - Increase groove angle.
C. INCOMPLETE FUSION	
1. Improper joint design 2. Presence of slag or oxide film 3. Incorrect electrode position and operating current 4. Improper manipulation of arc	- Increase included angle of groove joint. Change the groove design to a 'J' or a 'U' type. - Clean weld surfaces prior to welding. - Maintain proper electrode position and current. - Use correct manipulation techniques to melt the joint faces properly.
D. INADEQUATE PENETRATION	
1. Improper joint preparation a) Excessively thick root face b) Insufficient root opening c) Bridging of root opening 2. Electrode diameter too large 3. Inadequate current	- Use proper joint geometry. - Reduce root face height. - Use wider root opening. - Use smaller electrode in root. Increase root opening. - Follow correct welding current and technique.
E. CRACKS	
1. High rigidity of joint 2. Poor joint fit up 3. Higher carbon content of weld metal and/or hardenable base material 4. Too small a weld bead 5. High Sulphur content in base or weld metal 6. Hot cracking 7. Cracking at the crater 8. Higher hardenability 9. Hydrogen Induced cracking / Delayed cracking 10. Presence of brittle phases in the micro-structure of the base material 11. Low ductility of the base material 12. High residual stresses 13. Excessive dilution	- Use preheating. Relieve residual stresses. Minimize shrinkage stresses, using back step or block welding sequences. - Adjust root opening all alignment. - Use proper electrode. - Use buttering layers wherever necessary. - Decrease travel speed to increase cross section of bead. Increase electrode size. - Use filler with high level of sulphur fixing element like Mn. - Reduce the heat input. Minimum joint restraints. - Filling up the crater before withdrawing the electrode. Use taper power control device. Use back step welding technique. - Preheat the job. Post weld heat treatment without cooling to room temperature. - Use low Hydrogen welding electrode. Use suitable preheat and post weld heat treatment. - Soften the material before welding. - Use preheat. Anneal the base metal. Use ductile weld metal. - Redesign the weld metal and reduce restraints. Change welding sequence. Use intermediate stress-relief heat treatment. - Change welding current. Use buttering technique wherever possible.

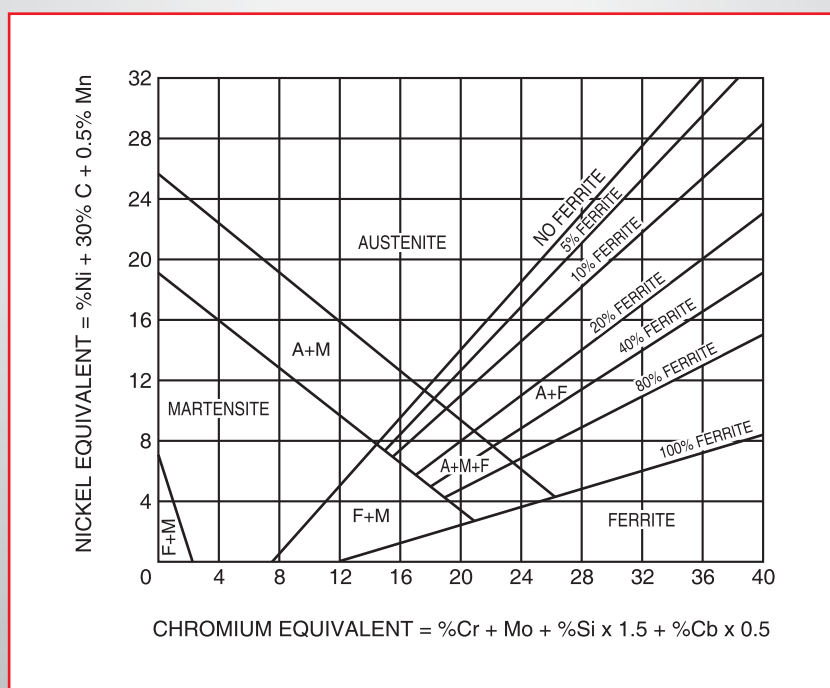
METALS PREHEATING CHART

METAL GROUP	METAL DESIGNATION	APPROXIMATE CARBON %	RECOMMENDED PREHEAT
PLAIN CARBON STEELS	PLAIN CARBON STEEL	Below 0.20	Up to 100°C
	PLAIN CARBON STEEL	0.20 - 0.30	100°C - 150°C
	PLAIN CARBON STEEL	0.30 - 0.45	150°C - 250°C
	PLAIN CARBON STEEL	0.45 - 0.80	250°C - 400°C
CARBON MOLY STEELS	CARBON MOLY STEEL	0.10 - 0.20	150°C - 250°C
	CARBON MOLY STEEL	0.20 - 0.30	200°C - 300°C
	CARBON MOLY STEEL	0.30 - 0.35	250°C - 400°C
MANGANESE STEELS	SILICON STRUCTURAL STEEL	0.35	150°C - 250°C
	MEDIUM MANGANESE STEEL	0.20 - 0.25	150°C - 250°C
	SAE T 1330 STEEL	0.30	200°C - 300°C
	SAE T 1340 STEEL	0.40	250°C - 400°C
	SAE T 1350 STEEL	0.50	300°C - 450°C
	12% MANGANESE STEEL	1.25	Usually not Required
HIGH TENSILE STEELS (SEE ALSO STEELS BELOW)	MANGANESE MOLY STEEL	0.20	150°C - 250°C
	MANTEN STEEL	0.35 Max.	200°C - 300°C
	MANTEN STEEL	0.30 Max.	200°C - 300°C
	ARMCO HIGH TENSIL STEEL	0.12 Max.	Upto 150°C
	DOUBLE STRENGTH #1 STEEL	0.12 Max.	150°C - 300°C
	DOUBLE STRENGTH #1A STEEL	0.30 Max.	200°C - 350°C
	MAYARIR STEEL	0.12 Max.	Upto 150°C
	OTISCOLOY STEEL	0.12 Max.	100°C - 200°C
	MAX. HIGH TENSILE STEEL	0.15 - 0.25	Upto 150°C
	CHOMANSIL STEEL	0.14 Max.	150°C - 200°C
	A.W.DYN-EL STEEL	0.11 - 0.14	Upto 100°C
	CORTEN STEEL	0.12 Max.	100°C - 200°C
	CHROME COPPER NICKEL STEEL	0.12 Max.	100°C - 200°C
	CHROME MANGANESE STEEL	0.40	200°C - 300°C
	YOLOY STEEL	0.05 - 0.35	100°C - 300°C
	Hi-STEEL	0.12 Max.	100°C - 250°C
NICKEL	SAE 2015 STEEL	0.10 - 0.20	Upto 150°C
	SAE 2115 STEEL	0.10 - 0.20	100°C - 150°C
	2 ½ # NICKEL STEEL	0.10 - 0.20	100°C - 200°C
	SAE 2315 STEEL	0.15	100°C - 250°C
MEDIUM NICKEL CHROMIUM STEELS	SAE 3115 STEEL	0.15	100°C - 200°C
	SAE 3125 STEEL	0.25	150°C - 250°C
	SAE 3130 STEEL	0.30	200°C - 350°C
	SAE 3140 STEEL	0.40	250°C - 400°C
	SAE 3150 STEEL	0.50	300°C - 450°C
	SAE 3215 STEEL	0.15	150°C - 250°C
	SAE 3230 STEEL	0.30	250°C - 350°C
	SAE 3240 STEEL	0.40	350°C - 500°C
	SAE 3250 STEEL	0.50	450°C - 550°C
	SAE 3315 STEEL	0.15	250°C - 350°C

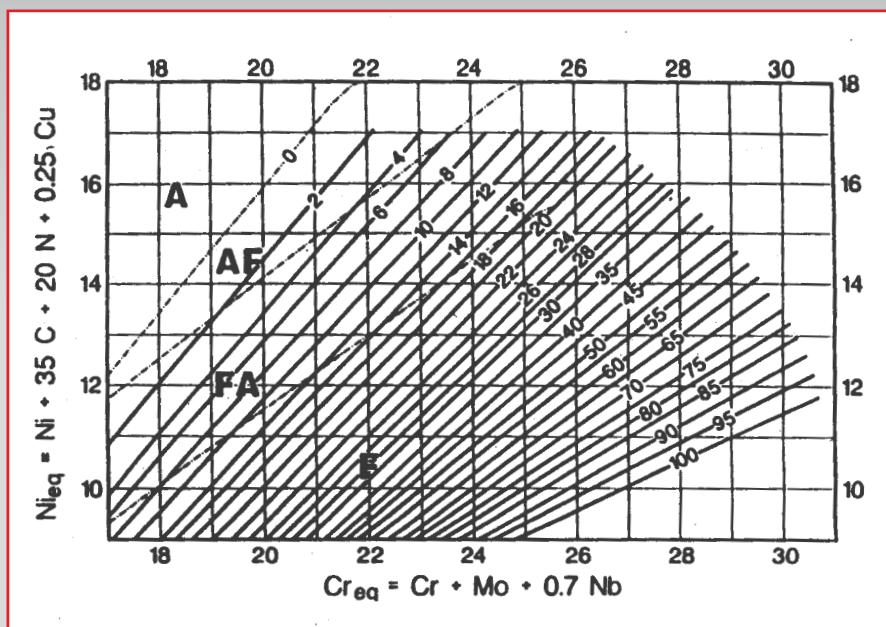
METALS PREHEATING CHART

METAL GROUP	METAL DESIGNATION	APPROXIMATE CARBON %	RECOMMENDED PREHEAT
MEDIUM NICKEL CHROMIUM STEELS	SAE 3325 STEEL	0.25	450°C - 550°C
	SAE 3435 STEEL	0.35	450°C - 550°C
	SAE 3450 STEEL	0.50	450°C - 550°C
MOLY BEARING CHROMIUM AND CHROMIUM NICKEL STEELS	SAE 4140 STEEL	0.40	300°C - 400°C
	SAE 4340 STEEL	0.40	350°C - 450°C
	SAE 4630 STEEL	0.30	250°C - 350°C
	SAE 4640 STEEL	0.40	300°C - 400°C
	SAE 4820 STEEL	0.20	300°C - 400°C
LOW CHROME MOLY STEELS	2% Cr. ½ % Mo. STEEL	Upto 0.15	200°C - 300°C
	2% Cr. ½ % Mo. STEEL	0.15 - 0.25	250°C - 400°C
	2% Cr. 1 % Mo. STEEL	Upto 0.15	300°C - 400°C
	2% Cr. 1 % Mo. STEEL	0.15 - 0.25	300°C - 400°C
MEDIUM CHROME MOLY STEELS	5% Cr. ½ % Mo. STEEL	Upto 0.15	300°C - 400°C
	5% Cr. ½ % Mo. STEEL	0.15 - 0.25	250°C - 400°C
	8% Cr. 1 % Mo. STEEL	0.15 Max.	300°C - 450°C
PLAIN HIGH CHROMIUM STEELS	12 - 14% Cr. Type 410	0.10	150°C - 250°C
	16 - 18% Cr. Type 430	0.10	150°C - 250°C
	23 - 30% Cr. Type 446	0.10	150°C - 250°C
	18 - 8 Cb.Type 347	0.07	

SCHAEFFLER DIAGRAM



WRC - 1991 DIAGRAM



SHIVA - SA SERIES FOR THERMAL POWER PLANTS

Low heat input welding electrodes

SI. No.	APPLICATION	BASE METAL	RECOMMENDATION
1.	I. D. Fan	Carbon steel	SHIVA-SA 3C
2.	Mills fan impellers	Cast steel	SHIVA-SA 3C
3.	Armour Plants of beater mills	Manganese steel	SHIVA-SA 3C
4.	Bearing of I. D. Fan	Cast steel	SHIVA-SA 2E
5.	Ash belt drums	Carbon steel	SHIVA-SA 3A
6.	Primary crusher bed plate	Cast iron	SHIVA-SA 6B & 4A
7.	Non return valve	Cast iron	SHIVA-SA 4A & 4B
8.	Coal crushing hammers	Cast steel	SHIVA-SA 2B & 3C
9.	Turbine housing	Alloy steel	SHIVA-SA 2E
10.	Springs	Spring steel	SHIVA-SA 2E
11.	Coal crushing hammers	Manganese steel	SHIVA-SA 3C
12.	Coal pulverizer liners	Manganese steel	SHIVA-SA 3C
13.	Pinion of ball mills	Cast steel	SHIVA-SA 2B & 3A
14.	Coal burner tips	Stainless steel	SHIVA-SA 2D
15.	Primary crusher teeth	Cast steel	SHIVA-SA 3A
16.	Non return valve	Cast steel	SHIVA-SA 2E
17.	Broken teeth of wagon tipper gear	Cast iron	SHIVA-SA 4A & 4B
18.	Coal pipe bend	Cast steel	SHIVA-SA 3C

SHIVA - SA SERIES FOR SUGAR INDUSTRY

Low heat input welding electrodes

Sl. No.	APPLICATION	BASE METAL	RECOMMENDATION
1.	All metal cutting operation	All metal	SHIVA-SA 6A
2.	All metal chamfering operation	All metal	SHIVA-SA 6B
3.	Gun metal bearing	Gun metal	SHIVA-SA 5A
4.	Bronze valves	Bronze	SHIVA-SA 5A
5.	Square ends	Cast iron	SHIVA-SA 4A
6.	Shredder cylinder	Cast iron	SHIVA-SA 4B
7.	Sprocket wheel teeth	Cast iron	SHIVA-SA 4B
8.	Gears	Cast iron	SHIVA-SA 4B
9.	Gear pump rotor	Cast iron	SHIVA-SA 4C
10.	Sprocket wheel teeth & pinion	Cast steel	SHIVA-SA 1B & 3A
11.	Pump blades	Carbon steel	SHIVA-SA 3A
12.	Square ends	Cast steel	SHIVA-SA 3A
13.	Cane grads	Cast steel	SHIVA-SA 3B
14.	Conveyor flights	Cast steel	SHIVA-SA 3B
15.	Cane leveller	Cast steel	SHIVA-SA 3C
16.	Cane cutting knives	Carbon steel	SHIVA-SA 3C
17.	Steam colter	Stainless steel	SHIVA-SA 2C
18.	Repair of furnace doors	Stainless steel	SHIVA-SA 2D
19.	Roll neck	Alloy steel	SHIVA-SA 2E
20.	Journals	Alloy steel	SHIVA-SA 2E
21.	Pump shaft	Alloy steel	SHIVA-SA 2E
22.	Pump rotor	Alloy steel	SHIVA-SA 2E
23.	Centrifuge	Alloy steel	SHIVA-SA 2E
24.	Shafts	Alloy steel	SHIVA-SA 2E
25.	Gears	Alloy steel /cast steel	SHIVA-SA 2E
26.	Cane feed rolls	Alloy steel	SHIVA-SA 80

SHIVA - SA SERIES FOR CEMENT INDUSTRY

Low heat input welding electrodes

1.	Cutting operation	All metal	SHIVA-SA 6A
2.	Chamfering operation	All metal	SHIVA-SA 6B
3.	Gun metal bearing and bronze value	Gun metal bronze	SHIVA-SA 5A
4.	Pump casting	Cast iron	SHIVA-SA 4A & 4C
5.	Coal pope bends	Cast iron	SHIVA-SA 4A
6.	Girth gear teeth	Cast iron	SHIVA-SA 4A & 4C
7.	Wheels	Cast iron	SHIVA-SA 1B & 3A
8.	Ropeway trolley grips	Carbon steel	SHIVA-SA 3A
9.	Mill gear & drive pinion	Cast steel	SHIVA-SA 1B & 3A
10.	Girth gear teeth	Cast steel	SHIVA-SA 1B & 3A
11.	Idler guides and rollers	Carbon/ alloy steel	SHIVA-SA 3A

SHIVA - SA SERIES FOR CEMENT INDUSTRY

Low heat input welding electrodes

SI. No.	APPLICATION	BASE METAL	RECOMMENDATION
12.	Jaw crusher plates	Alloy steel	SHIVA-SA 1B & 3A
13.	Crushing hammers	Manganese steel	SHIVA-SA 3C
14.	Shovel bucket teeth	Manganese steel	SHIVA-SA 3C
15.	Shovel bucket and lips	Manganese steel	SHIVA-SA 3C
16.	Cylinder mill teeth and crusher bar	Manganese steel	SHIVA-SA 3C
17.	F. K. pump screw	Carbon steel	SHIVA-SA 3C
18.	H. P. / I.D. fan blades	Mild steel	SHIVA-SA 3C
19.	Tracks links and shoes	Manganese steel	SHIVA-SA 3C
20.	Hopper	Mild steel	SHIVA-SA 3C
21.	Burner nozzle	Stainless steel	SHIVA-SA 2D
22.	Clinker inlet	Alloy steel	SHIVA-SA 2D
23.	Sprockets	Alloy steel	SHIVA-SA 2E
24.	F. K. pump shaft	Carbon steel	SHIVA-SA 2E
25.	Kiln tyre	Cast steel	SHIVA-SA 1B & 2E
26.	Kiln support roller	Cast steel	SHIVA-SA 2E
27.	Kiln roller shaft	Cast steel	SHIVA-SA 2E
28.	Slurry pump shaft	Cast steel	SHIVA-SA 2E
29.	Springs	Spring steel	SHIVA-SA 2E
30.	Under carriage frame repair	Mild steel	SHIVA-SA 1B

SHIVA - SA SERIES FOR ROAD TRANSPORT WORKSHOP

Low heat input welding electrodes

a) ENGINE			
1.	Cylinder block (cracked or broken)	Cast iron	SHIVA-SA 4B
2.	Cylinder head	Cast iron	SHIVA-SA 4B
3.	Pulleys (worn out)	Cast iron	SHIVA-SA 4B
4.	Rocker arm	Alloy steel	SHIVA-SA 2E
5.	Fly ring gear	Alloy steel	SHIVA-SA 2E
b) GEAR BOX			
1.	Housing worm out bearing area	Cast iron	SHIVA-SA 4C
2.	Gear of gear box	Cast iron	SHIVA-SA 4C
3.	Main drive shaft	Alloy steel	SHIVA-SA 2E
4.	Gear shift shaft	Alloy steel	SHIVA-SA 2B
c) DIFFERENTIALS			
1.	Differential housing	Cast iron	SHIVA-SA 6B, 4A & 4B
2.	Hypoid gear	Alloy steel	SHIVA-SA 2E
3.	Worn shaft pinion	Alloy steel	SHIVA-SA 2E
4.	Differentials	Alloy steel	SHIVA-SA 2E
d) CLUTCH			
1.	Gear box housing (cracked)	Cast iron	SHIVA-SA 6B & 4B
2.	Gear box housing (worn out)	Cast iron	SHIVA-SA 4B & 4C
3.	Clutch fork	Forge steel	SHIVA-SA 3A
4.	Gear shaft leveller	Forge steel	SHIVA-SA 2E
5.	Gear	Cast iron	SHIVA-SA 2E
6.	Top gear shaft	Alloy steel	SHIVA-SA 2E
7.	Main shaft	Alloy steel	SHIVA-SA 2E
e) PROPELLER SHAFT			
1.	Propeller shaft	Alloy steel	SHIVA-SA 2E
2.	Elongated holes of Flanges	Cast iron	SHIVA-SA 1B

APPROXIMATE COMPERATIVE CHART

AWS CODING	OUR BRAND	D & H SECHERON	ESAB INDIA	MODI ARC	ADOR ARC	GMM ARC
PIPE WELDING ELECTRODES						
E - 6010	SHIVA-6010	CELLUTHEREM	PIPE WELD 6010 R	STOVE-60 AP	CEWEL-60	-
RUTILE COATED MILD STEEL ELECTRODES						
E - 6013	SHIVA-TOUCH	-	FERRO ARC	STEEL ON SUPER	METALBOND/E BOND	GM-10
E - 6013	FERROCORD	-	FERRO ARC	STEEL ON SUPER	METALBOND/E BOND	GM-10
E - 6013	SHIVA WELD	NORMA	FERROSPEED PLUS/VORTIC	STEELON STANDARD	SUPER BOND	GM-20
E - 6013	SHIVA-S	MEDIO	ESAB 28/ VORDIAN	STEELON ULTRA	SUPER BOND-S	GM-30
E - 6013	SHIVA-SS	EXOBEL	VORTEX-1	REKORD	SUPER BOND-SS	GM-40
E - 7014	SHIVA-7014	RAPIDEX	VORTEX-2	MODI 7014	TOPSLAR-110	GM-14
E - 7024	SHIVA-7024	FERROVITE	ESAB C235	MODI 7024	TOPSLAR-140	GM-24
LOW HYDROGEN AND LOW ALLOY ELECTRODES						
E - 7016	SHIVA-7016	INDOTHERM	ESAB-56/FERRO WELD-1	MODI 7016	TENALLOY-16	GM-16
E - 7018	SHIVATHERME-18	SUPRATHERME	ESAB-36H/FERRO WELD-2	MODI 7018	SUPRABASE	GM-18
E - 7018-1	SHIVA -18 (SPL)	SUPRATHERME (SPL)	ESAB-36H (SPL)	MODI 7018 (SPL)	TENALLOY	GM-18 (SPL)
E - 7018 G	SHIVA -18 Ni	SUPRATHERME Ni	-	-	TENALLOY-R	-
E - 8018 G	SHIVA -18 Ni (SPL)	SUPRATHERME Ni (SPL)	OG 73.08	-	TENALLOY-60	GM-80G
E - 9018 G	SHIVA -9018 G	TENSAL	-	MODI 9018	TENALLOY-70	GM-90G
E - 9018 G1	SHIVA -90 D1	-	-	-	TENALLOY-65	GM-90 D1
E - 10016 G	SHIVA -10016 G	ULTRATHERME H	-	-	NIMOTEN PLUS	-
E - 11018 M	SHIVA -11018 M	ULTRA TENSAL MH	ESAB 118	MODI 110	TENALLOY-80	GM-110M
E - 7018 A1	SHIVA -18 A1	MOLYTHERME	OK 74.06	MODI 7018-A1	MOLYTEN	GM-18 A1
E - 8018 B2	SHIVA -CR-1	CHROMOTHERME -1	OK 76.18	MODI 9018 B2	CHROMOTEN	GM-80 B2
E - 9018 B3	SHIVA -CR-2	CHROMOTHERME -2	OK 76.28	MODI 9018 B3	CHROMOTEN-C	GM-90 B3
E - 8018 B6	SHIVA -CR-5	CHROMOTHERME -5	ESAB KV 4	MODI CHORM-5	CHROMOTEN-D	GM-80 B6
E - 8018 B8	SHIVA -CR-9	CHROMOTHERME -9	ESAB KV 7	-	CHROMOTEN-9	GM-80 B8
E - 8018 W2	SHIVA -8018 W2	CHROMOTHERME (SPL) -	-	MODI COR	ULTRACORTEN III	GM-80 W2
HARD SURFACING ELECTRODES						
-	SHIVA-HF I	BOR-A(R)	DUROID-250	HARDALLOY-200	ZEDALLOY-250	GM-25 R
-	SHIVA-HF-II	BOR-B	DUROID-350	HARDALLOY-400	ZEDALLOY-350	GM-40 R
-	SHIVA-HF-III	D & H-630 H	DUROID-650	MODI-600	ZEDALLOY-550	GM-55 R
-	SHIVA-HF-III (LH)	BOR-C	DUROID-650 B	MODI-650	ZEDALLOY-550 LH	GM-60 R
-	SHIVA-HF-V	SHC - SIX	-	SUPER HARD ALLOY	ZEDALLOY-VB	GM-HARD
-	SHIVA-MANGAN	SMA	DUROMANGAN	MODI Mn	ZEDALLOY-12 Mn	GM-Mn

APPROXIMATE COMPERATIVE CHART

AWS CODING	OUR BRAND	D & H SECHERON	ESAB INDIA	MODI ARC	ADOR ARC	GMM ARC
STAINLESS STEEL ELECTRODES						
E - 308 -16	SHIVA-308	RUTOX-A	OK-61.50	SS-308	SUPERINOX-1A	GM-308
E - 347 -16	SHIVA-347	RUTOX-A(ST)	OK-61.80	SS-347	SUPERINOX-1B	GM-347
E - 308 L -16	SHIVA-308L	RUTOX-B	OK-61.30	SS-308L	SUPERINOX-1C	GM-308L
E - 309 -16	SHIVA-309	CRONITHERME-25/12	OK-67.67	SS-309	BETANOX-D	GM-309
E - 309 L -16	SHIVA-309L	D & H-309L	OK-67.60	SS-309L	BETANOX-DL	GM-309L
E - 309 Cb -16	SHIVA-309Cb	D & H-309Cb	OK-67.68	SS-309Cb	BETANOX-D-Cb	GM-309Cb
E - 309 Mo -16	SHIVA-309Mo	D & H-309Mo	OK-67.70	SS-309Mo	BETANOX-D-Mo	GM-309Mo
E - 310 -16	SHIVA-310	D & H-310-16	OK-67.13	SS-310	BETANOX-C	GM-310
E - 312 -16	SHIVA-312	-	ESAB RSW	-	SUPERINOX-312	-
E - 316 -16	SHIVA-316	RUTOX-Mo	OK-63.50	SS-316	SUPERINOX-2A	GM-316
E - 316 L -16	SHIVA-316L	RUTOX-D	OK-63.50	SS-316L	SUPERINOX-2C	GM-316L
E - 410 -15	SHIVA-CR-13	D & H-13 Cr	OK-68.10	MODI-410	BETABOX-13Cr	GM-410
E - 430 -15	SHIVA-CR-17	D & H-17 Cr	-	MODI-430	BETACHROME-17Cr	-
E - 307 -15	SHIVA-307	SIA	CHROME WELD-G	MODI-SS Mn	BETANOX-ND	GM-307
NON-FERROUS ELECTRODES						
E-NiCrFe-3	SHIVA SUPER MONEL	D & H-1250	ESAB MONEL	-	SUPERMONAL	-
E-CuSN-A	SHIVA BRONZE	-	-	BRONZE ALLOY	BRONZE	GM BRONZE
CAST IRON ELECTRODES						
E-St	SHIVA-CAST	-	ESAB-56	GUSS	CASTEN	GM -CAST-1
E-Ni Cu B	SHIVA-MONAL	D & H MONAL	FERROLOID-1	MODI-Ni Cu	CAST MONAL	GM -CAST-4
E-Ni FeCl	SHIVA-FENI	D & H III-Cl	FERROLOID-3	CASTRON-Fe-Ni	FERRICAST	GM -CAST-3
E-Ni Cl	SHIVA-Ni-CAST	NFM	FERROLOID-4	CASTRON-KALT	CAST NICKLE	GM -CAST-2
ELECTRODES FOR METAL CUTTING & GOUGING						
-	SHIVA-CUT	CUTTING ELECTRODE	TERROCUT	CUT RODE	-	GM -CUT
-	SHIVA-CHAMFER	-	OK SELECTRODE 21.03	-	-	-

COMPARISON CHART OF LOW HEAT INPUT MAINTENANCE AND REPAIR ELECTRODES

Sl. No.	OUR BRAND	D & H LOTHERME	ESAB INDIA	MODI LOMELT	ADOR ARC	GMM ARC S.A. Series	L & T Eutectic
A. SPECIAL ELECTRODES FOR CARBON STEEL							
1	SHIVA -SA -1A	210	TERROWELD DMS	LOMELT 101	E 103	GMSA 11	HAND-O-MATIC
2	SHIVA -SA -1B	352	TERROWELD DLH	LOMELT 102	E 104	GMSA 12	XUPER 660 NH
3	SHIVA -SA -1C	-	-	LOMELT 103	-	GMSA 13	CPHFD 011
B. SPECIAL ELECTRODES FOR STAINLESS STEEL							
1	SHIVA -SA -2A	452	OK 61.41	LOMELT 201	E 124	GMSA 21	EUTEC STAINTRODE BL
2	SHIVA -SA -2B	455	OK 63.41	LOMELT 202	E 125	GMSA 22	EUTEC STAINTRODE AMOL
3	SHIVA -SA -2C	464	T/W S3 / T/W S4	LOMELT 203	E 126	GMSA 23	EUTEC STAINTRODE D
4	SHIVA -SA -2D	467	-	LOMELT 204	E 107	GMSA 24	EUTECTRODE 670
5	SHIVA -SA -2E	-	T/W Ds3	LOMELT 205 / 210	E 106 SMP	GMSA 25	EUTECTRODE 680 / 680 CGS
6	SHIVA -SA -2F	457	T/W DSI	LOMELT 206	E 108	GMSA 26	XHD 646
C. SPECIAL ELECTRODES FOR HARD FACING							
1	SHIVA -SA -3A	601	OK SELECTRODE 83.40	LOMELT 301	E 710	GMSA 31	EUTECTRODE 2B
2	SHIVA -SA -3B	602	-	LOMELT 302	-	GMSA 32	-
3	SHIVA -SA -3C	603	TERROWELD 65	LOMELT 303	E 711	GMSA 33	EUTECTRODE 2
4	SHIVA -SA -3D	604	-	LOMELT 307	-	GMSA 34	EUTECTRODE 700
5	SHIVA -SA -3E	605	T/W EWR	LOMELT 208	E 743 S	GMSA 35	CHROM CARB N 6006 E
6	SHIVA -SA -3F	607	ASTRA MN	LOMELT 206	E 714 S	GMSA 36	EUTECTRODE 400
7	SHIVA -SA -3G	-	-	LOMELT 310	-	GMSA 37	CPHFD 010
8	SHIVA -SA -3H	-	T/W SHR/COBALARE	LOMELT 315	E 745 S	GMSA 38	XHD ABROTEC N 6715
D. SPECIAL ELECTRODES FOR CAST IRON							
1	SHIVA -SA -4A	701	TERROWELD CLH	LOMELT 401	E 117	GMSA 41	EUTECTRODE 27
2	SHIVA -SA -4B	703	OK SELECTRODE 92.58	LOMELT 402	E 119	GMSA 42	XUPER 2240
3	SHIVA -SA -4C	705	-	LOMELT 403	E 115	GMSA 43	XYRON 224
4	SHIVA -SA -4D	704	OK SELECTRODE 92.18	LOMELT 404	-	GMSA 44	XUPERXYRON 242
E. SPECIAL ELECTRODES FOR BRONZE							
1	SHIVA -SA -5A	801	-	LOMELT 502	E 214 AC	GMSA 51	XHD 2800
F. SPECIAL ELECTRODES FOR CUTTING AND GOUGING							
1	SHIVA -SA -6A	801	TERROCUT	LOMELT 601	E 901	GMSA 61	EUTEC CUTTRODE
2	SHIVA -SA -6B	802	OK SELECTRODE 21.03	LOMELT 602	E 900	GMSA 62	EUTEC CHAMFERTRODE
G. SPECIAL ELECTRODES FOR CUTTING AND GOUGING							
1	SHIVA -SA -70	-	-	-	-	GMSA 70	-
2	SHIVA -SA -7A	514	OK SELECTRODE 92.35	LOMELT 702	E 717	GMSA 71	EUTECTRODE 6800
3	SHIVA -SA -7B	510/511	ESAB CN 182 CNIG	LOMELT 704	E 521	GMSA 72	XHD 2222
4	SHIVA -SA -80	-	OK CHAPSICO 84.77	LOMELT 380	E 738 S	GMSA RR	SUGARTEC AA
5	SHIVA -SA -90	-	-	-	-	GMSA 90	-