Schmiedewerke Gröditz
GmbH · since 1779 · High-Grade Steel

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REPAIR WELDING OF PLASTIC-MOULD-STEELS

INSTRUCTION

A) General

a. Clean the welding area carefully; remove oil, dirt, rust, etc.
b. Remove layers of chrome-plating / nitriding / case hardening - if any.
c. Flux to detect any possible cracks.
d. Avoid sharp edges, r = min. 3 mm.
e. PM-Steels are usually not welded at room temperature. Pre-heating and interpass temperature is determined by the type of steel, the size and shape of the tool.
f. Welding - and filler rod material analysis as near to analysis of workpiece as possible.
g. Welding has to be done with lowest heat input, which means using the lowest possible amperage and voltage.
h. On cracks sensitive steels apply short stringer beads with small diameter electrode or wires to avoid risk of cracks caused by shrinkage stress.
i. The welding deposit has to be peened immediately after a weld has been deposited and before the temperature falls below the lowest interpass temperature. **Never peen cold material.**
g. After welding slow cooling is necessary and eventually an annealing to reduce welding stress. A post heat treatment is a must after a large welding deposit has been made (large repairs, pattern change or similar).

B) Specific

1 . The welding of annealed workpieces:

1.1 Warm up thoroughly to the specific pre-heating temperature range (see page 2), weld at this temperature, re-heat, before the temperature of the tool falls below the minimum pre-heating (interpass) temperature.
1.2 Cool the workpiece down to 100°C in furnace or under insulating blankets.
1.3 Heat treatment after the welding: see page 2

2. The welding of h + t workpieces

2.1 Take care to avoid crack formation.
2.2 Repair only smaller areas resp. damages.
2.3 Warm up thoroughly to the specific pre-heating temperature range (see page 2) and weld at this temperature (re-heating: see section 1.1).
2.4 Heat treatment after the welding: see page 2

3. Special remark for crack sensitive Plastic-Mould-Steels

If no immediate thermic treatment can be made right after the welding has been finished, a stress-relieve annealing at 650°C must be made as soon as possible to avoid cracks.

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Steel-No	DIN - name	condition	preheating-temperature	welding-process	welding filler material	hardness weld metal	heat treatment after welding	remarks
1.0527	Ck 55	H + T	300-350°C	111 111 131+135 131+135	UTP 67 S UTP 65 D *) UTP A DUR 600 UTP A 651 *)	56-58 HRC ca. 240 HB 54-60 HRC ca. 240 HB	Tempering or new H + T process	10-20°C below the latest tempering temperature *) for intermediate layer
TGM	TIGERMOULD	H + T	300-350°C	111 111 131+135 141	SH Kupfer 1 K SH Kupfer 1 KC - Fontargen A 103 SW	ca. 170 HB ca. 180 HB - ca. 170 HB	no	H +T after bigger repairs
1.2311	40CrMnMo7	H + T	min. 350°C	111 111 131+135 141	UTP 73 G 3 Fontargen E 710 UTP A 73 G 3 UTP A 73 G 3	45-50 HRC ca. 43 HRC 42-46 HRC 42-46 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature
1.2738	40CrMnNiMo8.6.4	H + T	300-350°C	111 111 131+135 141	UTP 73 G 3 Fontargen E 710 UTP A 73 G 3 UTP A 73 G 3	45-50 HRC ca. 43 HRC 42-46 HRC 42-46 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature
XPM	-	H+T	300-350°C	111 111 131+135 141	UTP 73 G 3 Fontargen E 710 UTP A 73 G 3 UTP A 73 G 3	45-50 HRC ca. 43 HRC 42-46 HRC 42-46 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature
GEST80	GOLDEN EAGLE STAR 80	Solution treated and age hardened	320-400°C	111 111 131+135 141	 NAK-W NAK-W	 38-42 HRC 38-42 HRC	Aging (post-heat treatment)	10-20°C below the latest aging temperature
1.2083	X42Cr13	H + T	200-250°C	111 141 131+135 141	STAVAX WELD STAVAX TIG-WELD UTP A 73 G 2 *) UTP A 73 G 2 *)	54-56 HRC 54-56 HRC 53-58 HRC 53-58 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature *) not corrosion-resistant
1.2085	X33CrS16	H + T	200-250°C	111 131+135 141	STAVAX WELD UTP A 73 G 2 *) UTP A 73 G 2 *)	54-56 HRC 53-58 HRC 53-58 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature *) not corrosion-resistant
1.2316	X36CrMo17	H + T	250-300°C	111 131+135 141	STAVAX WELD UTP A 73 G 3 *) UTP A 73 G 3 *)	54-56 HRC 42-46 HRC 42-46 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature *) not corrosion-resistant
1.2344	X40CrMoV5.1	annealed	min. 325°C	111 111 131+135 141	QRO 90 WELD UTP 73 G 2 UTP A 73 G 2 QRO 90 TIG-WELD	50-55 HRC ca. 55 HRC 53-58 HRC 50-55 HRC	annealing	
1.2714	56NiCrMoV7	H + T	300-350°C	111	UTP 73 G 3	45-50 HRC	Tempering or	10-20°C below the latest tempering

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				111 131+135 +141	ESAB OK 83.28 UTP A 73 G 3 UTP A 73 G 4	38-42 HRC 42-46 HRC 38-42 HRC	new H + T process	temperature
Steel-No	DIN - name	condition	preheating-temperature	welding-process	welding filler material	hardness weld metal	heat treatment after welding	remarks
1.2767	X45NiCrMo4	H + T	250-300°C	111 111 131+135 +141	UTP 73 G 2 UTP 73 G 3 UTP A 73 G 2 UTP A 73 G 3	approx. 55 HRC 45-50 HRC 55-58 HRC 42-46 HRC	Tempering or new H + T process	10-20°C below the latest tempering temperature
1.2767	X45NiCrMo4	annealed	250-300°C	111 111 131+135 +141	UTP 73 G 2 UTP 73 G 3 UTP A 73 G 2 UTP A 73 G 3	ca. 55 HRC 45-50 HRC 55-58 HRC 42-46 HRC	annealing	
1.2379	X155CrVMo12.2	annealed	250-300°C	111 111 131+135 131+135	UTP 67 S UTP 65 D *) UTP A DUR 600 UTP A 651 *)	56-58 HRC ca. 240 HB 54-60 HRC ca. 240 HB	annealing	*) for intermediate layer

welding process (ISO 4063) :
111 – arc welding by hand
131 – metal inert gas welding (MIG)
135 – metal aktiv gas welding (MAG)
141 – Tungsten inert gas welding (TIG)