



Enhancing life of FORGING DIES

Forging is one of the most important manufacturing processes for steel products. The cost of forging dies is the critical variable that decides the cost of forged products. These costs can be reduced by extending the life of forging dies and by minimizing the use of costly die steels.

A Forging die is made of medium carbon low alloy steel with Cr, Ni, Mo, V, W alloy additions. They are AISI H11, H12, H13 type air hardenable Tool steels, DB6 steel DIN 1.2714 and are expensive hardened and tempered die steels. The die surface wears out gradually due to the combined effects of impact and friction during service and needs to be rebuilt by overlaying to re-establish its profile and thereby extend its life.

Die wear occurs due to a combination of following phenomenon:

- Wear due to abrasion
- Thermal fatigue
- Mechanical fatigue
- Permanent deformation

Merits of Die Life Enhancement:

- Extends the life of forging dies
- Enhances their performance
- Saves time.
- Drastically reduces die set inventory carrying costs.
- Reduces operating costs.

There are mainly two types of dies used in forging industries:

- Drop or Hammer Dies
- Press Forging Dies

Hardness requirement for these dies are 40 HRC and 50 HRC respectively.

AWL offers a reliable welding electrode NIMOTEN PLUS 535 B, a Cr-Ni-Mo alloyed electrode which meets 40 HRC hardness requirement of drop forging dies. It is used to repair and recondition defective and worn out dies.

High deposition rate is achieved using large size electrodes.

There are two methods for Die repair:

Overlay Welding: It is a technique of laying weld material on the die impression instead of complete flood welding. It is applied to overlay on shallow wear depth.

Flood Welding: A large amount of welded material is deposited onto the area to be welded. Die blocks that are imprinted and have become obsolete can be reclaimed for reuse by flood-welding. This method is particularly suitable for repairs on large dies.

Welding Procedure using Nimoten plus 535 B:

- Remove all cracked and worn out areas.
- Carbon arc gouging is mostly used after the dies have been suitably preheated.
- Make sure that sound surface has been reached.
- Preheating in a furnace for uniformity throughout the die.
- Use of asbestos cloth / glass wool / ceramic blanket to maintain preheating, reduce the cooling rate and to keep interpass temperature within the required limits.

- After each weld pass but while the weld is still hot, the slag to be removed and peening is required. Peening by pneumatic hammer to reduce residual stresses.
- Reheating in a furnace to 540°C to reduce local thermal gradients, and slow cooling to room temperature.
- Final PWHT for stress relieving and tempering must be selected according to the materials involved and must be applied with care.
- Machining as per forging profile

Correct heat treating is the essential factor for successful repair welding.

Job Details:

Component	Piston Die (Top and bottom)
Quantity	2 nos.
Die Material	DB6 (DIN 1.2714)
Hardness	38-42 HRC
Depth of Wear	Up to 5 mm
Welding Parameters:	
Product	NIMOTEN PLUS 535 B
Size, mm	4.00
Current, A	160-170
Preheating	400OC
Welding Method	Overlay Welding
Die Life:	
Earlier Die Life	<2000 nos.
Forging Die Life after rebuilding	2150 nos. 150 more than the nearest competitor's brand.



Preheated Die



Welding in progress



Welding complete

Case Study 2:

Component	Drop Forging Die
Die Material	DB6 (DIN 1.2714)
Hardness	38-42 HRC
Depth of Wear	Up to 10 mm
Welding Parameters:	
Product	NIMOTEN PLUS 535 B
Size, mm	4.00
Current, A	170-180
Preheating	400OC
Welding Method	Overlay Welding
Die Life:	
Earlier Die Life	<2000 nos.
Forging Die Life after rebuilding	2100 nos. 100 nos higher than the nearest competitor brand.

Nimoten Plus 535 B Technical Specifications:

Chemical Composition of Undiluted weld metal, Wt%:

	C	Mn	Si	Cr	Ni
Typical	0.1	0.4	0.2	0.8	2.1
Range	0.07-0.12	1.20-1.75	0.15-0.35	2.5-3.0	1.9-2.3

	Mo	V	S	P
Typical	1.4	0.15	0.02	0.02
Range	1.0-1.5	0.1-0.2	0.03 max	0-03

Mechanical Properties of all Weld Metal:

Condition		UTS, MPa	YS at 0.2% offset, MPa	EL%
Typical	As Welded	1100	940	19
Range		1000 - 1190	870 - 1040	15 mm
Hardness, 3 Layer: 300-410 BHN			Diffusible H2 Content: <5 ml/100 gm	

Parameters - Packing Data:

Ø x L, mm	Amperage, A	Approx. Pcs/Carton	Carton/Box	Approx. wt. of 1000 pcs, Kg.
4.0 x 450	140 x 180	79	4	63
5.0 x 450	190 x 230	32	4	156
6.3 x 450	260 x 320	28	4	179

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