



## HOT FORGING

Hot forging is the plastic deformation of metal at a temperature and strain rate such that recrystallization occurs simultaneously with deformation, thus avoiding strain hardening. For this to occur, high workpiece temperature (matching the metal's recrystallization temperature) must be attained throughout the process. A form of hot forging is isothermal forging, where materials and dies are heated to the same temperature. In nearly all cases, isothermal forging is conducted on superalloys in a vacuum or highly controlled atmosphere to prevent oxidation.

The following lubricants are recommended for hot forging applications:

<b>WATER BASE</b>							
<b>Product</b>	<b>Specific gravity (gms/cc)</b>	<b>Lubricant</b>	<b>Particle size Microns</b>	<b>Viscosity (cps at 25°C)</b>	<b>Diluent</b>	<b>Application</b>	<b>Packing (kgs)</b>
<b>Lubricote-Z 12</b>	1.15–1.20	Graphite	10-15	Creamy paste	Water	Hot closed die forging / upsetting. <u>Area of application:</u> Forging dies	200
<b>Lubricote-Z 12A</b>	1.18–1.20	Graphite	<10	Creamy paste	Water	Hot closed die forging/ upsetting. <u>Area of applicaion:</u> Forging dies	200
<b>Lubricote-Z 31</b>	1.04–1.10	Graphite	15 – 20	Paste	Water	General forging lubricant for steel & alloys <u>Area of application:</u> On dies	200
<b>Lubricote-Z 52</b>	1.28–1.30	Graphite	1 – 3	Paste	Water	For hot press forging of heavy, intricate, high quality forgings for smooth surface finish. <u>Area of application:</u> On dies with proper spraying system	25 200
<b>Lubricote-Z 63</b>	1.16–1.19	Graphite	1 – 2	Semi-paste	Water	For hot press forging of heavy intricate, high quality forgings for smooth surface finish. <u>Area of application:</u> On dies with proper spray system .	20 25 200



**OIL BASE**

<b>Product</b>	<b>Lubricant</b>	<b>Viscosity (CPS at 25°C)</b>	<b>Particle size Microns</b>	<b>Specific Gravity (gms/cc)</b>	<b>Diluent</b>	<b>Flash Point °C</b>	<b>Application</b>	<b>Packing (kgs)</b>
<b>Lubricote-X 21</b>	Graphite	1100-1300	110-120	0.90-1.00	Oil	120-130	Hammer forging lubricant for punch & die.	25 200
<b>Lubricote-X 21</b>	Graphite	1000-1200	35-40	0.97-1.00	Oil	>200	Hammer forging lubricant for punch & die. <u>Application:</u> Swabbing	25
<b>Lubricote-X 22</b>	Graphite	1600-2000	35-40	0.90-1.00	Oil	120-130	Lubrication of dies in Nosing operation.	25
<b>Lubricote-X 108</b>	Graphite	Semi liquid	10	1.00-1.10	Mineral	>240	ERFB bomb shell forging.	25
<b>Lubricote-X 126</b>	Graphite	Semi paste	<35	0.94-0.98	Mineral	>200	Hot forging lubricant for punch & die.	25



## WARM FORGING

Warm forging has a number of cost-saving advantages which underscore its increasing use as a manufacturing method. The temperature range for the warm forging of steel runs from above room temperature to below the recrystallization temperature, or from about 800 to 1800°F. However, the narrower range of from 1000 to 1330°F is emerging as the range of perhaps the greatest commercial potential for warm forging. Compared with cold forging, warm forging has the potential advantages of: Reduced tooling loads, reduced press loads, increased steel ductility, elimination of need to anneal prior to forging, and favorable as forged properties that can eliminate heat treatment.

The following lubricants are recommended for warm forging applications.

WATER BASE							
PRODUCT	Specific gravity (gms/cc)	Lubricant	Particle size microns	Viscosity (cps at 25°C)	Diluent	Application	Packing (kgs)
Lubricote-Z 27	1.20 - 1.24	Graphite	8-10	Creamy paste	Water	Hot forging and billet coating in warm forging. <u>Area of application:</u> Forging dies/Billet coating.	200
Lubricote-Z 54	1.00 - 1.07	Graphite	1-3	Paste	Water	For continuous sheet castings of aluminium. <u>Area of application:</u> On the upper and lower caster rolls by continuous automatic spray system.	25 200
Lubricote-Z 57	1.14 - 1.17	Graphite	1-2	Semi-paste	Water	Hot/warm press forging, extrusion of steel & alloys. <u>Area of application:</u> On dies with proper spray system.	25 200
Lubricote-Z 99	1.15- 1.17	Graphite	1-3	Semi liquid	Water	Hot press forging, half heavy intricate by high quality forgings for smooth surface finish. <u>Area of application:</u> On dies with proper spray system.	20
Lubricote-Z 504	1.15- 1.18	Graphite	1-3	Semi liquid	Water	For billet coating by dipping method	200



## PRECISION FORGING

Precision forging normally means close-to-final form or close-tolerance forging. It is not a special technology, but a refinement of existing techniques to a point where the forged part can be used with little or no subsequent machining. Improvements cover not only the forging method itself but also preheating, descaling, lubrication and temperature control practices.

The decision to apply precision forging techniques depends on the relative economies of additional operations and tooling vs. elimination of machining. Because of higher tooling and development costs, precision forging is usually limited to extremely high quality applications.

The following lubricants are recommended for precision forging applications.

Water base							
PRODUCT	Specific gravity (gms/cc)	Lubricant	Particle size microns	Viscosity (cps at 25°C)	Diluent	Application	Packing (kgs)
Lubricote-Z 51	1.10-1.12	Graphite	< 5	Semi-liquid	Water	Hot precision forging. Apply on dies with proper spray system	25 200
Lubricote-Z 513	1.14-1.16	Graphite	< 10	Semi liquid	Water	Hot precision forging. Apply on dies with proper spray system	25 200



## COLD FORGING

Most forging is done as hot work, at temperatures up to 2300<sup>0</sup> F, however, a variation of impression die forging is cold forging. Cold forging encompasses many processes – bending, cold drawing, cold heading, coining, extrusions and more, to yield a diverse range of part shapes. The temperature of metals being cold forged may range from room temperature to several hundred degrees.

The following lubricants are recommended for cold forging applications.

WATER BASE							
PRODUCT	Specific Gravity (gms/cc)	Lubricant	Particle size Microns	Viscosity (CPS at 25 Deg.C)	Diluent	Application	Packing (Kgs)
LUBRICOTE-Z 28	1.15-1.25	GRAPHITE	<10	SEMI-PASTE	WATER		20



## UPSETTING

Upset forging, also called hot heading, is a process by which the cross-sectional size of a bar is increased, either at an end or at some point along its length. It is done on specially designed upsetting machines, using closed dies to control size and shape. Typically, dies have several stations, and the parts are formed progressively by moving the parts from one die station or cavity to another until the forging is complete.

Heads of bolts, valves, single and cluster gear blanks, artillery shells, and cylinders for radial engines are examples of parts made by upset forging.

This same process, when performed cold, is called cold heading. Cold heading makes possible the economical mass production of fasteners; such as nails, screws, bolts, hinge pins, and rivets.

The following lubricants are recommended for Upsetting applications.

<b>Water Base</b>							
<b>PRODUCT</b>	<b>Specific Gravity (gms/cc)</b>	<b>Lubricant</b>	<b>Particle size Microns</b>	<b>Viscosity (CPS at 25°C)</b>	<b>Diluent</b>	<b>Application</b>	<b>Packing (Kgs)</b>
<b>LUBRICOTE-Z 12</b>	1.15-1.20	Graphite	10-15	Creamy Paste	Water	Hot closed die flogging / upsetting. Apply with proper spray system	200
<b>LUBRICOTE-Z 29</b>	1.15-1.20	Graphite	3 - 5	Paste	Water	Closed die hot forging of intricate and high quality precision forgings. Apply with proper spray system	200
<b>LUBRICOTE-Z 31</b>	1.04-1.10	GRAPHITE	15-20	PASTE	WATER	General forging lubricant for steel & alloys. Apply with proper spray system	200