

## **DURATHERM G** **MEDIUM / FAST SPEED QUENCHING OF STEELS**

**DURATHERM G** is a premium quality high speed quench oil. DURATHERM G is specially formulated using a select blend of paraffin base oils to promote optimum quench speed performance. Most conventional quench oils rely largely on speed enhancing additives to attain needed quenching characteristics thus compromising oxidation stability and quench uniformity due to the sludge forming degradation of such additives over time in service due to their sensitivity to various effects of agitation, moisture content, and thermal degradation.

DURATHERM G, in contrast, relies primarily on superior oil selection in concert with a highly stable additive which imparts excellent polymerization and oxidation inhibiting stability to deliver many years of useful oil life, consistently uniform cooling rates, less coking and brighter parts.

DURATHERM G's superior oil and additive selection contribute to its ability to separate from water readily. Its fast quenching properties are retained after water removal and are not affected or depleted by water. Small amounts of water (up to 2500ppm) will not adversely affect quenching characteristics.

### 1. TYPICAL PROPERTIES

Gravity: API	29.3
Viscosity, SUS @ 100F	85-95
Viscosity, cSt @ 40C	16.9-19.3
Viscosity Index	97
Flash Point, C.O.C. (F)	360
Pour Point, (P)	0
Color, ASTM D1500	D8
Neutralization number, mgKOH/g oil, max	.10
Ash, % wt.	.20
GM-Quenchometer speed, @ 80F )-w/ pure nickel ball	10-11 seconds
@ 80F )-w/ Cr nickel ball	13-14 seconds

## 2. APPLICATION

### 2.1 SCOPE

The medium-fast quenching effect of DURATHERM G is the reason for its wide range of applications. The oil is fast enough for fully hardening small parts made of plain carbon steels, like fasteners and high carbon spring wire. On the other hand, DURATHERM G does not quench so fast as to cause distortion on intricate parts which would occur during quenching in extremely fast quench oils. Consequently, DURATHERM G is successfully used for distortion-prone work, i.e. - large carburized transmission gears, and bearing races made of alloy steels.

Some typical applications are listed as follows:

- \* Hardening of fasteners - bolts, nuts, screws, usually in continuous furnaces with conveyORIZED quench tanks
- \* Hardening of steels having small grain size or a wide variation in grain size
- \* Hardening in steels lean in alloy content
- \* Ideal for use when minimum distortion is required in high hardenability steels, or in parts having odd shapes or variable sections

DURATHERM G can be used in open quench tanks, in integral quenching chambers under controlled atmosphere or vacuum and in quench presses for die quenching. DURATHERM G does not contain saponifiables. Thus, it can be used for quenching or work austenitized in salt baths of any suitable type.

### 2.2 Oil Temperature

The quenching effect of DURATHERM G is almost independent of its use temperature. For practical reasons it is usually maintained at temperatures between 40 and 95 C ( 100 - 200 F ). Higher or lower oil temperatures are possible without changes in the as- quenched hardness, but are rarely utilized.

Higher temperatures will cause faster aging of the oil and can lead to increased fuming. For safety purposes, the oil should never be used at temperatures above 100 C. The temperature range from 95 to 100 C should only be used for short periods of time to minimize distortion on very critical workpieces. Prolonged use at these high temperatures can lead to premature aging (sludging) of the oil.

Lower temperatures than 40 C (100 F) may result in more distortion because of the faster quenching effect of the oil which prevents proper agitation and rapid heat distribution. As a result, a comparatively thin layer of oil is heated at the part's surface and gets hotter as it flows upward. This oil can reach the air-oil hot workpiece interface with a temperature that is higher than its flash point or even its fire points, resulting in immediate ignition.

### 2.3 Quench Loads

The recommended capacity of an oil quench tank can be estimated by either of the following rules:

Volume of oil in liters = weight of quench load in Kg X 10

Volume of oil in gallons = weight of quench load in pounds

The two rules deliver somewhat different results, but the difference is only 17%. Either of the rules can be used for first approximations.

For large, massive parts, the oil volume can be much lower than estimated by the above rules. Such parts transfer heat comparatively slow to the oil. However, it will likely be necessary to install larger coolers and provide fast circulation from tank to cooler and back in order to maintain the oil temperature at a safe level (see section "Oil Temperatures").

#### 2.4 Optimum Conditions

DURATHERM G contains a very effective anti-oxidant which retards aging effectively. In order to assure a long service life of the oil, the following rules should be observed.

- The oil should be mechanically agitated to maintain a uniform temperature. Strong agitation should only be used when work is actually quenched. NEVER use agitation by means of bubbled-through compressed air.

- Heating elements used for warming DURATHERM G should have less than 1.5 watts/cm@ (10.0 watts/sq.inch) in order to prevent localized overheating which would cause aging of the oil (polymerization) but also the formation of an insulating layer of oil-coke on the heater with possible results of heating element burnouts.

- The quenching system and particularly heating elements and coolers should not consist of copper or copper alloys. These materials act as catalysts, accelerating the aging of mineral oils. Use steel, ferrous castings, stainless steel, nickel plated or tin plated materials instead. Existing copper or brass equipment should be tin plated.

#### 3. Control and Service

Routine analysis to determine the state of the oil should be performed periodically. The oil should be checked as follows:

Crackle test (water)

Sludge

Viscosity @ 100 F

GM Quenchspeed

Upon request used samples of DURATHERM G (minimum: one pint) will be checked free of charge at Maxim Oil & chemical for physical and chemical properties as well as for quenching effect.

Water in quench oils is very dangerous. Not only does it cause non-uniform or insufficient as quenched hardness of the work, but also heavy foaming and increased fire hazard because oil foam catches fire very easily. Thus it is recommended to check for water, either continuously (water in tank sentinels installed in the quench tank) or, if water is suspected, (non-uniform hardness, heavy foaming of the oil, etc.) by means of the "Crackle Test" and/or "Xylene Distillation".

#### Packaging

DURATHERM G is available in 55 gallon steel drums or in bulk quantities.

For additional information, product samples, etc., please contact:

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