Technical Handbook

Industrial Oils & Lubricants

Apar Industries Ltd.

"Tomorrow's Progress Today"

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About Apar Industries Ltd.

Apar Industries Limited, founded by Late Mr. Dharmsinh D. Desai in the year 1958 is one among the best established companies in India operating in the diverse fields of electrical, metallurgical and chemical engineering. Over the ensuing years it has evolved to be a 700 million US Dollar diversified company offering additional value added products and services in Power Transmission Conductors and Petroleum Specialities.

A technology – driven and customer – focused vendor to some of the most brand-enhancing power companies in India and abroad, Apar has strengthened the business of its customers through proactive product development, timely product delivery and superior product attributes by reinforcing product innovation, cost leadership and premium quality and living its vision 'Tomorrow's Progress Today' resulting in Reliability, Respect, Reputation and Repeat business across manufacture of Speciality Oils and Power Conductors.

Apar manufactures a wide range of Industrial / Automotive and Speciality Lubricants at its state-of-art blending plants at Rabale - Thane and Silvassa (D.N.H) under SCADA controlled operations accredited with ISO 9001-2000 & ISO 14001-2004 quality systems providing high accuracy blending. Its Quality Control Laboratory is also accredited with NABL.

The comprehensive range comprising more than 150 Grades includes Hydraulic Oils, Gear Oils, Compressor Oils, Long Life Turbine Oils, Cylinder Oils, Refrigeration Oils, Metal Working Fluids, Marine Oils, Wire Drawing Compounds, Automotive Engine Oils, Gear Oils,Transmission Fluids, Glass Mould Oils, Mould Release Oils, Quenching Oils, Thermic Fluids, Industrial and Automotive Greases, etc. and other speciality industrial oils for specific applications meeting the latest BIS and International Standard specifications. These Lubricants are manufactured utilizing Hydro-treated group II and/or Hydro-cracked group III base oils, which give distinct advantage in performance over the similar products made utilizing conventional base oils.

The well-equipped sophisticated laboratory at our Rabale facility includes special testing equipments like Trace Metal Analyzer, FTIR, UV Analyzer, Particulate Counter, Cold Cranking Simulator, Rust Analyzer, Foaming & Emulsion Test Apparatus, Air Release Value and 4 Ball Well Load Testing equipment etc., to offer effective pre and post sales services to our customers. On-line vacuum and micro filters are also part of our production systems, which ensure clean and super clean oils meeting the stringent NAS 1638 classification requirements.

Circulating and Hydraulic Oils

Power transmission utilizing a hydraulic system has wide range of applications in automotive, construction and industrial machinery. It is used in systems where multiplication of force is required as well as in a system where accurate and reliable controls are provided. Hydraulic oils are used as media in hydraulic system and play a crucial role in the functioning of hydraulic systems.

Apar range of high performance hydraulic fluids ensure that your hydraulic systems work at peak performance even under the toughest conditions.

Apar has developed the following grades that meet 3 different performance levels:

- Power hydrol- used for equipments running under moderate conditions
- Power hydrol HLP- to be used for machinery operated under critical conditions
- Power Ultimo- to be used where broad operating temperature range is expected.

Normally hydraulic fluids will degrade with use; some faster than others depending upon base oils, additive combinations and operating conditions. Apar hydraulic oils give optimum performance as they are formulated from highly refined, hydrocracked base stocks and selected additive package.

Apar grades possess the following characteristics:

- Right viscosity to satisfy the demands of the hydraulic pump and to provide adequate oil film between moving parts for their lubrication
- High viscosity index to resist viscosity changes under operating conditions
- Resistance to oxidation and thermal degradation
- Excellent water separation characteristics
- Good seal compatibility
- Excellent anti rust and anti corrosion properties.

POWER MACHINOL - GENERAL PURPOSE MACHINERY OILS

PERFORMANCE STANDARDS

BIS: 11695-1986

CHARACTERISTICS	POWER MACHINOL							
ISO VG	32	46	68	100	150	220	320	460
Colour (ASTM)	1	2	2	3	3.5	4	4	4.5
Kinematic Viscosity @40°C, cSt	29-35	42-50	62-72	90-100	135-155	200-230	290-350	415-425
Flash point, COC, °C, min.	180	180	180	200	210	220	230	260
Pour point, °C, max.	-3	-3	-3	0	0	0	0	0
Rust test (D-665)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

APPLICATION

- Recommended for lubrication of all types of industrial machines using once through lubrication systems.
- Recommended for lubrication of machine tools, textile machinery and lightly loaded moving components of industrial machines.
- High viscosity grades are recommended for lubrication of small open gears operating under light duty conditions with intermittent lubrication.

PERFORMANCE BENEFITS

- Effective lubrication under light and medium loads as they maintain thin film of oil
- Excellent rust and corrosion protection even during machine idle periods
- Perform well even under boundary lubrication conditions

POWER HYDROL - SUPERIOR ANTIWEAR HYDRAULIC OILS

PERFORMANCE STANDARDS:

BIS: 10522 – 1983 (Reaffirmed 1993) and Vickers V-104C vane pump test
DIN – 51524 –Part II in case of antiwear characteristics
The product range exceeds the performance standard limit of BIS 10522 for FZG Gear test

CHARACTERISTICS	POWER HYDROL				
ISO VG	32	46	68	100	150
Colour (ASTM)	< 1.5	< 2	< 2.5	3.5	4
Kinematic Viscosity @ 40°C, cSt	29-34	43-48	64-72	95-105	145-155
Viscosity Index, min.	90	90	90	90	90
Flash point, COC, °C, min.	190	200	210	210	230
Pour point, °C, max.	-3	-3	-3	-3	-3
Rust Test (D-665)	Pass	Pass	Pass	Pass	Pass
FZG Gear fail stage	10	10	10	10	10

APPLICATION

- Recommended as fluid media for hydraulic systems and hydraulic pumps in stationary as well as mobile equipments under moderate operating conditions.
- Recommended for circulation, splash, bath and ring oiling systems of both plain and anti-friction bearings, gears of industrial machinery, chain drives and crankcase lubrication.
- Not recommended for lubrication of turbines and equipments having white metal, silver or silver coated components.

PERFORMANCE BENEFITS

- Offer superior anti wear properties compared to normal grades meeting the same IS specs
- Higher film strength results in exceptional equipment performance
- Good rust and corrosion protective properties, prevents internal hydraulic system corrosion. Reduces negative effects of moisture in systems
- Excellent oxidation resistance quality and good de-foaming properties provides longer oil & equipment life & also extends filter life

POWER HYDROL HLP - ANTIWEAR SPECIAL PURPOSE HYDRAULIC OILS

PERFORMANCE STANDARDS

BIS: 10522-1983 (Reaffirmed 1993) and BIS: 11656-1986
DIN 51524 Part 2
Vickers M-2950 S
Cincinnati Milacron P-68, P-69 & P-70
Meets Denison HF- 0 requirement
Approved by Bosch Rexroth

CHARACTERISTICS	POWER HYDROL HLP			
ISO VG	32	46	68	100
Colour (ASTM)	0.5	< 1.0	1.0	< 1.5
Kinematic Viscosity @ 40°C, cSt	29-32	43-48	64-72	95-105
Viscosity Index, min.	105	105	105	100
Flash point, COC, °C, min.	200	204	210	210
Pour point, °C, max.	-6	-6	-6	-6
Rust Test (D-665)	Pass	Pass	Pass	Pass
Steel corrosion test- DIN 51585	(0-A)	(0-A)	(0-A)	(0-A)
FZG Niemann EP Test – Fail Stage	12	12	12	12

APPLICATION

- Suitable for use in industrial machinery operating under critical conditions.
- Recommended for lubrication of screw compressors, vacuum pumps, mining machinery and machine tools where EP types of oils are required. These are specially recommended for sophisticated high performance electro-hydraulic or numerically controlled systems.
- Designed for use in most Industrial system, which requires high level of anti-wear protection.

PERFORMANCE BENEFITS

- Excellent anti-wear performance reduces wear Protects systems using various metallurgy and reduces the cost of replacement of parts
- Good oxidation and thermal stability provides long oil & equipment life. Extends

filter life

- Good water tolerance protects systems where small quantities of moisture are present. Readily separates larger quantity of water
- Excellent hydrolytic stability- leading to higher product life and consistence performance
- Provides superior long term protection against rust & corrosion
- Ensures overall problem free performance

POWER ULTIMO HIGH PERFORMANCE ANTIWEAR HYDRAULIC OILS FOR ALL-SEASONS.

Power Ultimo oils are formulated with latest generation anti-wear hydraulic oil additive packages with high Quality Base stocks to meet and maintain high performance with improved Wet filterability characteristics..These oils are multi-grade anti-wear hydraulic oils designed to deliver premium performance meeting following Standards:

PERFORMANCE STANDARDS

Denison Hydraulic HF-O, HF-2 (Also meets T6H20C dry and wet phase performance)
Eaton M-2950-S and Eaton I-286-S3
Cincinnati Milacron P-68,P-69 and P-70
DIN 51524 part II and part III
AFNOR NF E 48-603 (HM)
ASLE 64-1 TO 64-4, 70-1 TO 70-3
CETOP RP91H
Approved by Bosch Rexroth

CHARACTERISTICS	POWER ULTIMO		
ISO VG	32	46	68
Colour (ASTM)	2.0	2.0	2.5
Kinematic Viscosity @ 40°C, cSt	29-32	43-48	64-72
Viscosity Index, min.	150	145	140
Flash point, COC, °C, min.	200	204	210
Pour point, °C, max.	-40	-36	-33
Rust Test (D-665)	Pass	Pass	Pass
FZG Niemann EP Test – Fail Stage	11	12	12

APPLICATIONS

- These are recommended for use in hydraulic and fluid power transmission systems subjected to low temperature conditions.
- The multi-grade viscosity characteristics makes it suitable for extreme temperature application
- Most Suitable for off highway equipments, heavy earth moving and construction equipments,
- Recommended for Screw compressors, portable compressors and circulating systems even under subzero temperatures where similar ISO VG oils are recommended.

PERFORMANCE BENEFITS

- Excellent Anti-wear properties
- Low Temperature Fluidity
- Very High Shear Stability
- Superior Water Tolerance
- Good Oxidation and Thermal Stability
- Extended Pump durability

Gear Oils

Gears are mechanical devices used for transmission of mechanical power and motion. The main function of gear oil is to reduce friction and power consumption. The application criteria set by the gear box manufacturers demand the gear oil not only to perform in adverse conditions like high temperature, lower sump size, low clearance between shaft and gear teeth etc. but also maintain it's properties in high temperature and heavy load conditions.

Industrial gears are of two types, enclosed and open. The enclosed gears are lubricated by splash lubrication or a pressure regulating system in which oil is sprayed. In case of open gears the lubricants are applied by hand or by automatic drip or spray method.

The choice of oil depends on tooth loading and pitch line speed. In general with increase in tooth loading, viscosity of oil should be increased. Low viscosity gear oils are used for high speed gears.

POWER GEAR SP - PREMIUM ENCLOSED GEAR BOX OILS

PERFORMANCE STANDARDS

BIS: 8406-1985 (Reaffirmed 1993)
IPSS: 1–09-003, AGMA 9005- D94
AGMA Standard 250-04, 5EP , & DIN 51517 Part 3
ASLE Standard G-315, G-1000, G-1500 and G-2150
US Steel requirement No 224, David Brown S1.53.101 (E)
Cincinnati Milacron, USA Specification No. P-63, P-76, P-77,P-74, P-59,P-35

CHARACTERISTICS	POWER GEAR SP					
ISO VG	68	100	150	220	320	460
Colour (ASTM)	3	3	3	4	5	6
Kinematic Viscosity. @ 40 ° C, cSt	64-72	95-105	145-155	210-230	320-350	420-500
Viscosity index, min	95	95	95	95	95	90
Flash point, COC, °C, min.	200	200	200	230	232	232
Pour Point, °C, max.	-6	-6	-6	-6	-3	-3
Rust test (D-665)	Pass	Pass	Pass	Pass	Pass	Pass
FZG Niemann EP Test Pass load stage, Min.	12	12	12	12	12	12

APPLICATION

- Recommended for lubrication of heavy duty enclosed gear drives with circulation or splash lubrication systems operating under heavy or shock loading up to operating temperature of 110 °C.
- Recommended for systems, with plain and roller bearings, sliding surfaces, chain drives, sprockets, flexible coupling employing splash, circulation or spray lubrication systems, requiring oil to withstand extreme pressures.
- Not suitable for lubrication of gear systems with brass, bronze and white metal components.

PERFORMANCE BENEFITS

- Good de-foaming qualities
- Good extreme pressure properties
- Good demulsibility properties and excellent water protection

- Long service life
- Minimise sludge and deposit formation

RECOMMENDATION

Power Gear SP grades are recommended for Leading Gear Box Manufacturers like David Brown, Krupp Industries GmbH, Dorr Oliver GmbH, Mannesmann Demag, Renk & Pfeiffer AG etc.

POWER HYDGEAR - ANTIWEAR GEAR & CIRCULATING OILS

PERFORMANCE STANDARDS

BIS-8406 -1993

CHARACTERISTICS	POWER HYDGEAR		
ISO VG	220	320	460
Colour (ASTM)	5	5	5
Kinematic Viscosity @ 40°C, cSt	210-230	315-350	440-500
Viscosity Index, min.	95	95	95
Flash point, COC, °C, min.	230	230	260
Pour point, °C, max	-3	-3	-3
Rust test (D-665)	Pass	Pass	Pass
FZG Gear Load stage Fail, Min *	10	10	10

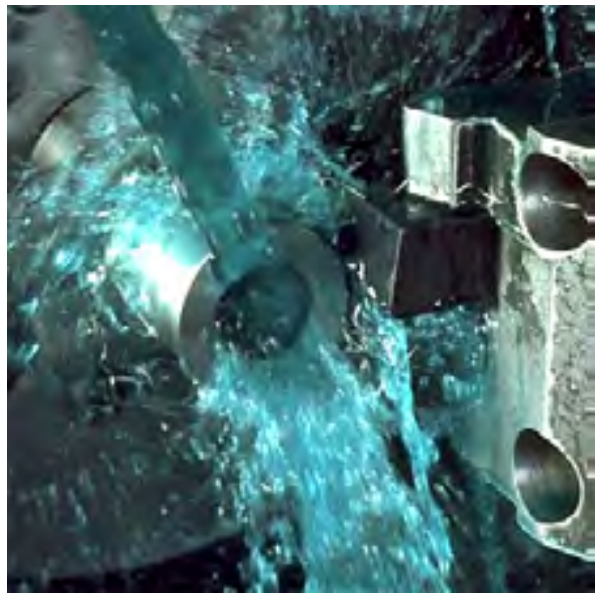
**check IS spec*

APPLICATION

- Recommended for lubrication of enclosed gear-drives operating under non-critical conditions and gear units made from non-ferrous material.
- Recommended for use in continuous circulation systems.
- Suitable for lubrication of anti-friction bearings of paper mill drier rolls, plastic film calendars, paper corrugators, coal pulverizer and various other ore and rock crushing machinery.
- Also recommended for lubrication of compressors, machine tools, hydraulic systems and chain drives.

PERFORMANCE BENEFITS

- Good resistance to sludge formation and undesirable system deposits
- Superior anti- wear & high film strength characteristics offers longer life to moving parts
- Excellent rust and corrosion protection characteristics
- Good de-foaming properties
- Longer oil drain interval and system clean-up period
- Excellent oxidation resistance characteristics



Metal Working Oils

Metal working oils are used in in metal removing and forming application. The primary function of metal working oils is to allow higher cutting speeds and to prolong the life of cutting tools. Other functions such as improving surface finish, corrosion protection for tool, machine components and workpiece, cleanliness of machine surfaces are equally important.

Metal working oils are classified into following categories:

1 Neat cutting oils
2 Soluble cutting oils
3 Semi-synthetic oils
4 Synthetic oils

Neat oils are used in moderate to heavy duty operations in which lubrication is of prime importance. These are used as supplied without any dilution. The products are applied copiously to flood the work-tool-chip area thoroughly to get maximum cooling effect to increase tool life and production.

Apar manufactures different grades of neat oils. These products are blend of solvent refined mineral oils and additives and are formulated considering operation, metal and performance requirements.

Apar neat oils range include:

Apar NS- Oils non staining type- NS
Apar NS- Oils staining type- NS

Other three types are emulsifiable in water and are used in light to moderate duty

operations. These products are a blend of refined mineral oil, emulsifier, additives and suitable bactericides and can be used for ferrous and non ferrous metals.

These are not recommended to be used for machining of magnesium and its alloys due to risk of fire hazard.

These are further categorized as:

- General purpose soluble cutting oil- consists of mineral oil, emulsifier and other additives. Widely used in industry and are least expensive.
- Semi synthetic oils- contain mineral as well as synthetic components to meet lubrication and cooling requirement of certain operations.
- Synthetic oils- These do not contain mineral oil and provide best cooling among all.

Preparation of soluble oil emulsion

In preparing the emulsion of soluble oils with water, always add the oil to the water and not vice/ versa to prevent inversion of emulsion. The requisite quantity of oil is to be added to two to three parts of water to prepare concentrated emulsion. This can be diluted by adding it to requisite quantity of water in the tank.

To achieve the optimum performance of the soluble cutting oil:

- Total water hardness must be below 250 ppm.
- Chloride and sulphate in water should not exceed 50 ppm

POWER CUT A12 - ALUMINIUM NEAT CUTTING OIL

CHARACTERISTICS	POWERCUT A12
Kinematic Viscosity @ 40°C, cSt	12
Flash point, COC, °C, min.	160
Pour point, °C, max	-6

APPLICATION

- Recommended for machining aluminium components, particularly in drilling, cutting and grinding operations where it provides superior surface finish. Also suitable for magnesium, brass and soft metals.

PERFORMANCE BENEFITS

- Better surface finish
- Longer cutting tool life
- Higher heat dissipation

POWERCUT NF-9 (BR) - Neat cutting oil

PERFORMANCE STANDARDS

BIS: 3065 - 1985
CUTTING OIL, NEAT TYPE 1 GRADE II

Typical Product Data

Description	Apar Powercut NF-9(BR)
Appearance	Yellowish liquid, bright & clear
K V @ 40 °c Cst	20-30
Viscosity Index(Min)	105
Acid Value (mgKOH/gm)	2.8
Flash Point °c (PMCC)	160
Foam test	40/0
Saponification No	9
Weld load, Kg	200 min

APPLICATION

Operation	Alloy Steel	Low & High Carbon Steels	Aluminium & Alloys	Copper & Alloys	Cast Iron
Cylindrical Grinding	†	†	z	z	†
Drill Flute Grinding	†	--	--	--	--
Centre less Grinding	†	†	z	z	†
Surface Grinding	†	†	z	z	†

† Preferred. z Probable

Product Benefits

- Better Finish & No Burn Marks even during severe operations like drill flute grinding
- Low viscosity offers a better flushing and cooling due to higher heat dissipation.
- Longer Tool life
- Low fuming and hence environment & operator friendly

POWER MET-15 - ALUMINIUM WIRE DRAWING OIL

CHARACTERISTICS	POWER MET 15
Kin.viscosity @ 40°C, cSt,	220-240
Viscosity Index (Min)	100
Density @ 15 °C	0.890 (T)
Flash point, °C,	240
Saponification value -mg KOH /gm	18-20
Copper strip corrosion, 3 Hrs. @ 100°C, max	1

APPLICATION

- Recommended as wire drawing lubricant during aluminium wire drawing operation
- Suitable for use as wire drawing lubricant with different class of dies

PERFORMANCE BENEFITS

- Excellent lubrication characteristics ensuring good die life
- Good wetting characteristics offering ease of drawing
- Better surface finish

POWERCUT NS 1000 SERIES - PREMIUM METAL WORKING OILS

PERFORMANCE STANDARDS

BIS: 3065 - 1985
Upgrade of NEAT TYPE 3

Characteristics	POWERCUT NS					
	NS-1012	NS-1018	NS-1024	NS-1032	NS-1037	NS-1040
Specifications	-	Grade I	Grade I	Grade II	Grade II	Grade II
Kinematic Viscosity@40°C, cSt	10-14	15-20	20-25	26-35	35-40	37-42
Flash point, COC, °C, min.	135	160	160	160	160	160
Reactive sulphur @ 100°C, % by mass, min.	0.5 synth. Comp.	0.5 synth. Comp.	0.5 synth. Comp.	0.5 synth. Comp.	0.5 synth. Comp.	0.5 synth. Comp.
Copper strip corrosion at 100°C for 3 hrs.	Staining	Staining	Staining	Staining	Staining	Staining

APPLICATION

- Recommended for severe metal cutting operations e.g. gear cutting, broaching and threading on ferrous metals and alloys.
- Powercut NS 1012 is recommended for gun drilling application.

PERFORMANCE BENEFITS

- Better surface finish
- Longer cutting tool life
- High Weld load characteristics reflecting suitability for arduous machining operations
- Lower wear scar diameter lower
- Effectiveness of machining in relation to cost
- No scope for “drop out” of active sulpher

POWERCUT NS - SUPERIOR METAL WORKING OILS

PERFORMANCE STANDARDS

BIS: 3065 - 1985
NEAT TYPE 2 – Non-staining

CHARACTERISTICS	POWERCUT NS			
	NS-20	NS-32	NS-46	NS-65
Specification	Grade II	Grade III	Grade IV	Grade IV
Kinematic Viscosity @ 40°C, cSt	15 – 25	30-45	45-55	60-65
Flash point, COC, °C, min.	135	160	160	160
Pour point, °C, max	0	0	0	0
Copper strip corrosion at 100°C	Non staining	Non staining	Non staining	Non staining

APPLICATION

- These oils are recommended for machining operations of high tensile stainless steel as well as nickel-chromium alloys on automates, gear cutting, hobbing, drilling/reaming and thread cutting machines
- Power cut NS 46 grade is suitable for high speed nut forming application and thread rolling application.

PERFORMANCE BENEFITS

- Better surface finish
- Longer cutting tool life
- Non corrosive & non staining to non-ferrous metals
- Wide application areas

POWER HONE 7 - CHLORINE FREE HONING OIL

CHARACTERISTICS	POWER HONE 7
Appearance	Clear red liquid
Kinematic Viscosity @ 40°C, cSt	6.0 – 7.0
Density @ 20°C	0.83
Flash point, °C (PM closed)	120

APPLICATION

- Recommended for honing / micro finishing applications on toughened steels e.g. bearing steels and nickel alloys etc.
- Suitable for light drawing and forming applications.
- Suitable for fine boring and crank shaft super finishing application.

PERFORMANCE BENEFITS

- Offers best in class surface finish to machined/honed components
- Chlorine-free product resulting in lower used oil disposal cost
- Excellent inherent oxidation resistance characteristics

POWER HONE 7S - CHLORINE FREE HONING OIL

CHARACTERISTICS	POWER HONE 7S
Appearance	Clear Amber Liquid
Kinematic Viscosity @ 40oC, cSt	5.0- 6.0
Copper corrosion 100 C 3 Hrs	1a
Density @ 20oC	0.83
Flash point, oC (PM CC)	120

APPLICATION

- Recommended for honing / micro finishing of both Ferrous & Non Ferrous metals to achieve Superior surface finish
- It can be used for honing operation of toughened steels e.g. bearing steels and nickel alloys etc.
- It can also be used for grinding application.
- Suitable for light drawing and forming applications.

	Cast Iron	Low Medium Alloy Steel	High Alloy Steel/Nickel Chromium Alloy	Aluminum Alloy	Yellow Metal
Honing/Super finishing	Y	Y	Y	Y	Y
Grinding	Y	y	Y	Y	Y
Drilling					
General Machining				Y	Y

PERFORMANCE BENEFITS

- Offers best in class surface finish to machined/honed components
- Chlorine-free product resulting in lower used oil disposal cost
- Excellent oxidation resistance characteristics

POWER METCUT S-PLUS - GENERAL PURPOSE SOLUBLE CUTTING OIL

PERFORMANCE STANDARDS

BIS: 1115- 1986*

CHARACTERISTICS	POWER METCUT S-PLUS
Appearance	Dark Brown Clear Liquid
Specific Gravity @29.5°C	0.890 (T)
Kinematic Viscosity @ 40°C, cSt, min	20
Flash point, COC, °C, min	150
PH (5% Emulsion D/W)	9
Emulsion Stability Test (24 Hrs) at 5:1 & 20:1 ration in 400 ppm Hard water (as CaCO3)	Stable Emulsion
Thermal Stability Test (at 0 °C & 50°C	Pass
Cast iron corrosion test (IP-125)	Pass

** Exceeds BIS: 1115 – 1986 specs w.r.t. hard water stability.*

APPLICATION

- Recommended for wide range of metal working operations on both ferrous and non-ferrous metals.
- Excellent cutting fluid for applications like turning, milling, drilling and tapping, etc.
- Suitable for use even with higher hardness of water.
- Suitable for use as pickling oil during cold rolling of steel.
- Can be recommended as general-purpose coolant.
- Recommended water quality: Total hardness- 50-250 ppm; Chlorides- Less than 50 ppm

PERFORMANCE BENEFITS

- Very good cooling and lubricating characteristics
- Ensures long grinding wheel life while in use as grinding coolant
- Highly stable emulsion even in hard water
- Operator friendly
- Economical to use due to its longer sump life
- Excellent rust protection to machined components

POWER SYNTHCOOL 50 - Synthetic Grinding Cutting Fluid

PERFORMANCE STANDARDS

BIS: 11186-1985 (Reaffirmed 1990)

Typical Physical Characteristics

CHARACTERISTICS	POWER SYNTHCOOL 50
Appearance	Clear liquid
Density @ 29.5 °C	0.998 (T)
Emulsion Test – 20:1 ratio in tap water & 500 ppm hard water	Translucent & Stable
Thermal Stability Test	Passes
Cast iron corrosion Test @ 3%, 200 ppm	<1
PH 2% dilution with D.M water	9.5
Refractometer Reading Factor	2.16

APPLICATION

- Power Synthcool 50 is recommended for grinding of cast iron & Low carbon steel. They are the right choice for grinding where wheel grains must cut continuously with out any blockage of grains.
- Power Synthcool 50 is recommended for Surface, cylindrical, Double disk & centre-less grinding operations
- Recommendation for Cast iron, Low carbon steel
- Recommended water quality: Total hardness- 50-250 ppm; Chlorides- Less than 50 ppm

PERFORMANCE BENEFITS

- Excellent cooling and lubricating properties
- Reduces Wheel Loading & Dressing frequency
- Long grinding wheel life as a grinding coolant
- Stable clear emulsion even in very Hard water
- Offers excellent rust protection
- Nitrite & Chlorine free hence environmentally safe.

POWER SYNTHCUT 25 - Semi Synthetic Cutting Fluids

Typical Physical Characteristics

CHARACTERISTICS	POWER SYNTHCUT -25
Appearance of concentrate	Clear Amber fluid
Density @ 29.5 °C	1.01
Emulsion –Appearance	Clear & Translucent
Thermal Stability Test	Passes
Cast iron corrosion Test @ 3%, 200 ppm(IP 287)	No Rust
PH 5% dilution in Distilled water	9.25
Refractometer Reading multification Factor	1.5

APPLICATION

- Power Synthcut –25 is recommended for wide range of metal working operation.
- Suitable for metal cutting & grinding of ferrous & its alloys
- Material Compatibility
  - Cast Iron
  - Ferrous Alloys
  - Stainless steels
- Recommended water quality: Total hardness- 50-250 ppm; Chlorides- Less than 50 ppm

PERFORMANCE BENEFITS

- Excellent cooling and lubricating properties
- Good emulsion stability and long coolant life
- Stable emulsion even in hard water
- Offers excellent rust protection
- Reduces machine down time
- Nitrite & Chlorine free hence environmentally safe.

POWER SYNTHCUT EP 40 - EP Semi-Synthetic Soluble Cutting Fluid

Typical Product Characteristics

CHARACTERISTICS	POWER SYNTHCUT EP-40
Appearance of concentrate	Clear Amber fluid
Density @ 29.5 °C	0.95
Emulsion –Appearance	Clear & Translucent
Thermal Stability Test	Passes
Cast iron corrosion Test @ 3%, 200 ppm(IP 287)	No Rust
PH 5% dilution in Distilled water	9.5
Refractometer Reading multification Factor	1

APPLICATION

- Power Synthcut EP 40 is recommended for wider range of metal working operations.
- Most suitable for metal cutting & grinding of ferrous & non Ferrous materials including Copper & Aluminum and its alloys
- Material Compatibility
  - Cast Iron
  - Ferrous Alloys
  - Stainless steels
  - Aluminum & alloys
- Recommended water quality: Total hardness- 50-250 ppm; Chlorides- Less than 50 ppm

PERFORMANCE BENEFITS

- Excellent cooling and lubricating properties
- Suitable for wide range of materials & operations
- Good emulsion stability and long coolant life
- Stable emulsion even in hard water
- Offers excellent rust protection
- Reduces machine down time
- Nitrite & Phenol free hence environmentally safe.

Quenching Oils

Quenching refers to the process of rapid cooling of steel components after heating for sufficient time at a certain temperature to impart strength and hardness.

The media used for quenching include water, mineral oil, molten salt, brine solutions and synthetic oils. But mineral oil based quenching medium find the widest application because of the following benefits:

- Control is easier and uniform hardness can be achieved
- Suitable for large scale applications
- These oils are non corrosive and non toxic.

Apar grades are specially formulated from highly refined mineral oils with additives and have the following characteristics

- Excellent thermal stability
- Good oxidation and chemical stability
- Low volatility
- High flash and fire point.

POWER QUENCH 11 & SL 11 - MEDIUM FAST HEAT TREATMENT OILS

PERFORMANCE STANDARDS

BIS: 2664-1980

CHARACTERISTICS	POWER QUENCH	
	11	SL 11
Type	Compounded	Additive
Kinematic Viscosity @ 40°C, cSt	27 - 33	27 - 33
Viscosity index, min	90	90
Flash point, COC, °C, min	190	190
Pour point, °C, max	0	0
TAN, mg KOH/gm, max	0.5	0.5
Copper strip corrosion, 3 hrs. @ 100°C (ASTM)	1	1
Evaporation loss @ 150°C, 2 hrs., % Wt.	2.5	2.5
Maximum cooling rate °C/sec	70	85

APPLICATION

- Exclusively recommended as quenching oil for components and material to have desired hardness characteristics through accelerated quenching operations.
- Especially suitable for quenching of high speed tools, ball bearings and other components.

PERFORMANCE BENEFITS

- Accelerated quenching characteristics
- Imparts uniform hardness to quenched components
- Reduced consumption due to low volatility properties
- Lower oil loss due to reduced oil carry over
- Good chemical and oxidation stability

POWER QUENCH 32 M - GENERAL PURPOSE HEAT TREATMENT OIL

PERFORMANCE STANDARDS

BIS: 2664-1980 straight mineral type, grade medium

CHARACTERISTICS	POWER QUENCH 32 M
Kinematic Viscosity @ 40°C, cSt	27 - 35
Viscosity index, min	90
Flash point, COC, °C, min.	194
Pour point, °C, max	0
TAN mg KOH/g, max	0.05
Ash, % wt.	0.01
Copper strip corrosion @ 100 °C, 3 hrs.	1
Evaporation loss @ 150°C, 2 hrs, % wt.	2.5
Maximum cooling rate °C/sec	65

APPLICATION

- Recommended for normal quenching operations of wide variety of steel products to achieve desired hardness levels without causing any distortion.
- Best in class conventional quenching oil suitable for quenching of high-speed tools, ball bearings, nuts, bolts, set screws, crankshafts, axles, steering arms, brake drums and components etc.

PERFORMANCE BENEFITS

- Excellent quenching characteristics
- Long service life due to excellent oxidation stability
- Reduced consumption due to lower volatility characteristics
- Reduced fire hazard due to excellent high temperature characteristics
- Imparts uniform hardness without distortion

POWER QUENCH SUPER 20 - SUPERIOR HEAT TREATMENT OIL

PERFORMANCE STANDARDS: BIS: 2664-1980

Properties	Specification	Typical Values
Appearance	Dark Liquid	Dark Liquid
Colour	D 8.0	D 8.0
Density @29.5 Deg C	To Report	0.832
Viscosity @ 40 Deg C, cSt	17.00 – 20.00 cSt	19
Viscosity Index	+ 95 Min	120
TAN mg KOH/gm	0.2 Max	0.1
Flash Point Deg C (COC)	180(Min)	190
Pour Point Deg C	- 6 max	Below – 15
Moisture ppm	100 Max	40
Maximum cooling rate °C/sec	-	100

APPLICATION:

- Power Quench Super 20 is fortified with special additive, which imparts accelerated quenching characteristic to the oil and make it suitable for quenching of high-speed tools, ball bearing, Rollers & Pins, Nuts & Bolts, Coil Springs & Crown Wheel & Pinions
- Power Quench Super 20 is used in many critical applications where precision and uniformity of heat treatment are important

FEATURES	BENEFITS
High and uniform/constant rate of cooling	Improved as quenched hardness. Deeper & More uniform hardening , High Tensile Strength in Carburized steel, improved toughness in carbon steel
Suitable viscosity at operating temperature	Ensures proper Quenching and reduces carry over losses & ease of cleaning at post quenching operation
Low volatility at operating temperature	Minimizes the loss due to evaporation

Slow cooling / Low rate of heat transfer in the final stage	Minimises the cracking & distortion of quenched part
High Thermal & Oxidation Stability	Reduces the Sludge formation , minimizes the oil thickening resulting in extended oil life

POWER QUENCH 7 & C70 - SUPERIOR HEAT TREATMENT OILS

PERFORMANCE STANDARDS

BIS: 2664-1980

CHARACTERISTICS	POWER QUENCH	
Type	7	C70
Kinematic Viscosity @ 40°C, cSt	19-25	19-25
Viscosity index, min	90	90
Flash point, COC, °C, min	175	180

APPLICATION

- The medium speed quenching characteristics make Power Quench 7 suitable for general purpose quenching application e.g. hardening of bolts, set screws, crankshafts, cam shafts, axles, steering arms, etc.
- Power Quench C70 is fortified with special additive, which imparts accelerated quenching characteristic to the oil and make it suitable for quenching of high-speed tools, ball bearing and nuts, etc.
- Power Quench C70 is recommended for quenching of components after nitriding.

PERFORMANCE BENEFITS

- High oxidation and thermal stability
- Good wetting characteristics
- High fluidity
- Reduced consumption due to lower volatility characteristics
- Delivery of desired hardness levels without any distortions

Thermic Fluids

Thermic fluids are meant for transferring the heat energy from source to receptor.

Application of heat to a system or process may be direct (by using a flame or electric heater) or indirect using a circulating fluid with a separate heater.

Indirect heating offers the prominent advantages such as:

- Absence of hot spots
- Central heat source can be used to meet the several heat requirements of different processes.

Thermic fluid is a medium used in indirect well controlled heat transfer system used in industry.

Apar manufactures Powertherm 500 and Powertherm 600 from finest quality base stocks and selected anti oxidants. These oils have high specific heat and better thermal conductivity upto operating temperature and provide rapid heating and greater flexibility in heat transfer systems.

POWER THERM - PREMIUM HEAT TRANSFER OILS

CHARACTERISTICS	POWER THERM	
	500	600
Appearance	Clear	Clear
Colour	<0.5	<0.5
Density @29.5 ^{0} C	0.848	0.847
Kinematic Viscosity, cSt, @ 40^{o}C	31	31.5
@ 50^{0}C	21.19	21.29
@ 100^{o}C	5.44	5.4
@ 200^{0}C	1.419	1.415
@ 300^{0}C	0.700	0.699
Viscosity index, min.	107	108
Flash point, Open, ^{o}C, min	216	218
Flash point, Closed, ^{0}C, min	212	214
Fire point ^{0}C	232	234
Pour point, ^{o}C, max	-15	-15
TAN, mg KOH/g. max.	0.01	0.01
Spontaneous ignition temperature ^{0}C	>350	>350
Initial boiling point ^{0}C	362	367
Final boiling point ^{0} C	440	442
CCR Wt %	<0.02	<0.02
Max film temperature ^{0}C	320	340
Coefficient of thermal expansion (/^{0}C) @ 150 ^{0}C	0.00078	0.00078
Specific Heat Kcal/ Kg ^{0}C		
260 ^{0}C	0.657	0.659
280 ^{0}C	0.673	0.679

300 ^{0}C	0.68	0.683
Thermal Conductivity Kcal/ hr- mt ^{0}C		
260 ^{0}C	0.094	0.0993
280 ^{0}C	0.091	0.098
300 ^{0}C	0.090	0.0967

APPLICATION

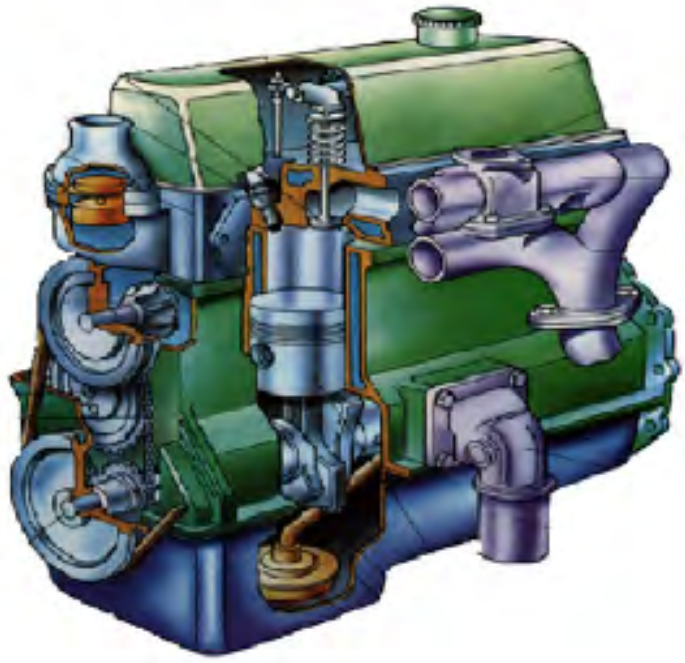
Powertherm oils are suitable for direct and secondary heating in conventional heat transfer operations in Textile, Pharmaceutical, Chemical and Processing Industries. Powertherm 500 is recommended for use in heat transfer systems operating with bulk oil temperature up to 300^0 C. Due to its high specific heat and better thermal conductivity at all temperatures, this oil provides rapid heating and greater flexibility in heat transfer systems. Powertherm 600 provides superior performance on account of its low sulphur content and CCR value and is recommended for well designed heat transfer systems operating with bulk temperature up to 320^0 C

ADVANTAGES OF USING MINERAL OIL

- Mineral oils have high boiling point and therefore can be used without pressurization at maximum bulk temperature.
- Absence of high pressure facilitates efficient compact units and associated space savings.
- Low volatility.

PERFORMANCE BENEFITS

- Long and trouble free service life in a well designed heat transfer systems due to high thermal and oxidation stability.
- Excellent heat transfer medium due to high specific heat and good thermal conductivity, which enables more flexibility in heat transfer systems.
- Efficient performance in wider range of temperatures. Free from toxicity and obnoxious odour.



Automotive Engine Oils

Your engine is a complex machine with hundreds of moving parts that operate under a wide range of temperatures and stresses. The oil you select needs to be equally capable of coping with these operating conditions to provide engine protection against wear, corrosion and build up of dirt and carbon deposits. By carefully selecting the best oil for your vehicle, you can improve engine performance, extend engine life and reduce emissions.

Apar brand engine oils are manufactured by selecting premium quality hydrotreated (group II) and hydrocracked (group III) base oils and special additives to meet the highest performance level which offer following benefits:

- Engine protection against wear
- Engine cleanliness
- Long engine life

POWER ENGINE 40 & 20W40 - ENGINE OILS

PERFORMANCE STANDARDS

E-DL 1 / E-PL 1 of IS-13656-1993
US MILITARY MIL-L-2104 B
API SERVICE SC/CC

CHARACTERISTICS	POWER ENGINE	
	40	20W40
Colour	Red	Red
Kinematic Viscosity @ 100°C, cSt	13 – 16	13.5 – 15.5
Viscosity index, min	90	98
Flash point, COC, °C, min	225	200
TBN mg KOH/g, Min	6	6

APPLICATION

- Recommended for use in naturally aspirated diesel engines / petrol engines operating under moderate duty conditions.

PERFORMANCE BENEFITS

- Improved corrosion resistance
- Reduces wear
- Keeps engine parts clean for longer period
- Minimises deposits on piston rings, valves and guides
- Excellent lubrication of engine parts

POWER PRIDE - CRANKCASE & DG SET ENGINE OILS

PERFORMANCE STANDARDS

E-DL 3 of BIS-13656-1993
US Military MIL-L-2104C
API SERVICE CD CF/SE Plus MACK T7

CHARACTERISTICS	POWER PRIDE			
	MONO GRADE		MULTI GRADE	
SAE GRADE	30	40	15W40	20W40
Kinematic Viscosity @ 100°C, cSt	10-12	13-15	13.5-15.5	13.5-15.5
Viscosity index, min.	95	90	110	105
Flash point, COC, °C, min	220	225	200	200
Pour point, °C, max.	-6	-6	-18	-18
TBN, mg KOH/gm.	6.5	7.0	8.0	8.0

APPLICATION

- Recommended for use in naturally aspirated and turbo charged / super charged diesel engines.
- Also suitable for use in generating sets operating on Distillate fuels.
- Power Pride 20W/40 is recommended for use in all petrol engines, especially for high performance and fuel-efficient engines.

PERFORMANCE BENEFITS

- Maintains high order of engine cleanliness.
- Excellent oxidation and thermal stability to resist decomposition in service
- High alkaline reserve to combat corrosive wear that may result from use of high sulphur fuels
- Longer service life

POWER ENGINE CF4 15W40 - I.C. ENGINE / DG SET OILS

PERFORMANCE STANDARDS

API CF4/SF
VW 505 issue 11/92
Daimler Benz 228.1
MAN 271
CCMC D4 and PD-2
Mack EO-K2
Allison C-4

CHARACTERISTICS	POWER ENGINE CF4
	15W40
Kinematic Viscosity, @ 100°C, cSt	13.5-15.5
Viscosity index, min	120
Flash point (PMCC), °C, min	200
Pour point, °C, max	-18
TBN, mg KOH/gm	7

APPLICATION

- Recommended for use in modern and low emission diesel engines. It is also suitable for petrol engines of modern cars.

PERFORMANCE BENEFITS

- Ease in cold starting due to very high viscosity index
- Maintains high order of engine cleanliness
- Prevents engine parts from rusting and corrosion
- Outstanding protection against high temperature engine deposits, oil degradation, oil thickening and corrosion resistance

POWER ENGINE CH4 15W/40 - I.C. ENGINE OIL

PERFORMANCE STANDARDS

API CH4/CG4/CF4/CF2/CF/SL
MAN 271
ACEA E7-04
Volvo VDS-2
ACEA B4 -04/A4-04
MACK EO-M PLUS
Cummins CES 20,076/20,007
MB 228.3 Blanket/MB 229.1
MTU Type 2
CATERPILLER ECF-1a

CHARACTERISTICS	POWER ENGINE CH4
	15W/40
Kin.viscosity, @ 100°C, cSt	13.5-15.5
Viscosity index, min	120
Flash point (PMCC), °C, min	200
Pour point, °C, max	-18
TBN mg KOH/g ,Min	7

APPLICATIONS

Recommended for use in modern and low emission diesel engines. It is also suitable for petrol engines of modern cars.

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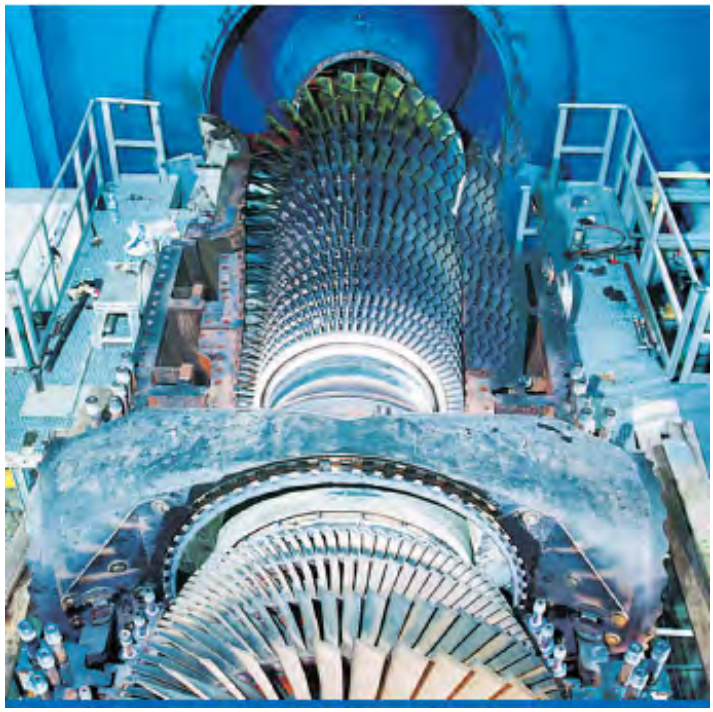


Turbine Oils

Apar power turbo grades are premium quality turbine oils made from paraffinic base stocks having excellent oxidation and chemical stability. These properties are further enhanced by selected additives.

Turbine lubeoil systems have many missions. Among the most important: cooling bearings, flushing contaminants away from rotating parts, providing hydrostatic lift for shafts, actuating valves in the hydraulic circuit, and coating and lubricating the system internals.

Formulating lubricants capable of performing all these tasks well is a difficult job, one that must consider the impacts of large temperature fluctuations and ingress of contaminants such as dirt and water, as well as other physical and chemical challenges.
With time since the specifications set by turbine manufacturers have been amended with the changes in design, turbine oils have undergone several advancements.

Turbine oils have undergone several advancements as turbine oil specifications have been amended. Turbine oils must now simultaneously meet the requirements of both steam and gas turbines. Improvements in base oil refining technologies provide more thermally stable and oxidatively robust products. Coupled with improvements in additive chemistries, modern turbine oils represent a delicate blend of lubrication science. Almost 99% of turbine oils are base oil with additives making up the remaining percent. There are several different additives in turbine oils such as antioxidants, rust inhibitors, metal deactivators, antifoam agents, demulsifier, pour depressants and antiwear additives. The most abundant additives are antioxidants,

which have the strongest influence on the life of turbine oil. Apar Trubine oils are the perfect blend of High quality Gr-2 base oils with a special additives to minimize the oxidation and sludge formation and enhance the life of the oil

POWER TURBO - PREMIUM TURBINE BEARING LUBRICANTS

PERFORMANCE STANDARDS

BIS:1012-1987 (Reaffirmed 1993);
U.S. Military MIL-L-17672D;
Brown Boveri HT GD 90 117E;
Alstom Atlantique NBA P50001;
CEGB 207001;
U.S.Steel 120 and 125 (Bench Test);
British Standard BS 489:1983
German Standard DIN 51515
General Electric GEK-28143 A
General Electric GEK-46506 B
General Electric GEK-141003H
Siemens - TLV -901304

CHARACTERISTICS	POWER TURBO		
ISO VG	32	46	68
Kinematic Viscosity @ 40 °C, cSt	28-33	42-48	64-72
Viscosity index, min	105	105	100
Flash point, COC, °C, min	190	200	210
Pour point, °C, max	-9	-6	-6
TAN mg KOH/gm	0.1	0.1	0.1
Rust test (D-665 A & B 24 hrs)	Pass	Pass	Pass
Air release value @ 50 °C, minutes,	3	4	6

** Non-standard grades like Power Turbo –57 & 100: Available on request depending on MOQ.*

APPLICATION

- Recommended for lubrication of steam, hydraulic and gas turbines.
- Suitable for hydraulic systems requiring lubricant with excellent anti-oxidation characteristics.
- Recommended for lubrication of turbo-compressors.

PERFORMANCE BENEFITS

- Excellent demulsibility
- Excellent ability to release entrained air
- Thermally stable
- Good rust and corrosion protection
- Long service life

POWER TURBO AW OILS

PERFORMANCE STANDARDS

BIS:1012-1987 (Reaffirmed 1993);
U.S. Military MIL-L-17672D ;
Brown Boveri HT GD 90 117E;
Alstom Atlantique NBA P50001;
CEGB 207001 ;
U.S.Steel 120 and 125 (Bench Test);
British Standard BS 489:1983
German Standard DIN 51515
General Electric GEK-28143 A
General Electric GEK-46506 B
General Electric GEK-141003H
Siemens - TLV -901304

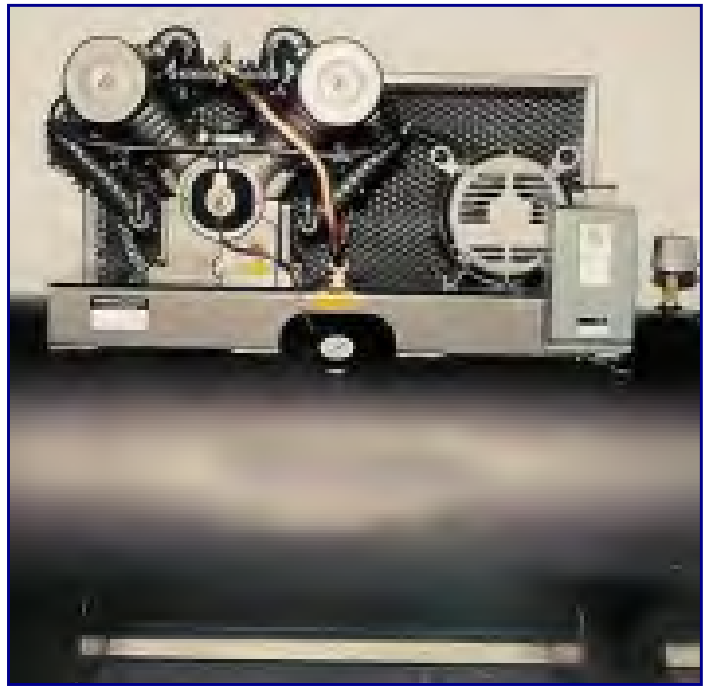
CHARACTERISTICS	POWER TURBO AW	
ISO VG	32	46
Kinematics viscosity @ 40°C, cSt	28-33	42-48
Viscosity index, min	100	98
Flash point, COC, °C, min	190	200
Pour point, °C, max	-9	-6
TAN mg KOH/gm	0.1	0.1
Rust test (D-665 A & B 24 hrs)	Pass	Pass
FZG Rating – Failure Load – Stage	11	12
Air release value @ 50°C, minutes,	3	4

APPLICATION

- Recommended for lubrication of steam, hydraulic and gas turbines
- Suitable for hydraulic systems requiring lubricant with excellent anti-oxidation characteristics.
- Recommended for lubrication of turbo-compressors

PERFORMANCE BENEFITS

- Excellent demulsibility
- Excellent ability to release entrained air
- Thermally stable
- Good rust and corrosion protection
- Long service life



Compressor Oils

Compressors are used in operations requiring compressed air. It is essential to operate compressors without any pressure loss. Apar compressor oils meet the requirement of high performance and specifically designed compressor lubricant. This ensures compressors to operate with greater reliability in today's tough conditions. Power compressor oils are recommended for lubrication of heavy duty reciprocating and rotary air compressors.

POWER PRESS 100, 150 & 220 - PREMIUM COMPRESSOR OILS

PERFORMANCE STANDARDS

BIS- 13256-1992
ISO DIS-6521
DIN 51506VD-L

CHARACTERISTICS	POWER PRESS		
ISO VG	100	150	220
Colour	3.5	4	5
Kinematic Viscosity @ 40°C, cSt	90 - 110	135 - 165	210-230
Viscosity index, min	95	95	90
Flash point, COC, °C, min	210	220	230
Pour point, °C, max	-6	-6	-6
CCR % Wt. (typical)	0.05	0.15	0.4
Rust test D-665 (A&B) 24 hrs	Pass	Pass	Pass

APPLICATION

- Recommended for lubrication of heavy-duty reciprocating and rotary air compressors even encountering air discharge temperature up to 220o C.
- Suitable for lubrication of reciprocating and rotary compressors of most OEM's e.g. Ingersoll – Rand, Atlas copco, ELGI, Chicago pneumatic etc. as product is designed to meet OEM stated performance levels provided oil of OEM stipulated viscosity grade is selected.

PERFORMANCE BENEFITS

- Good lubrication even under extended high operating temperature and high load condition
- Exceptional thermal stability characteristics
- Good corrosion and rust protection properties
- Reduce oil consumption due to low volatility characteristics
- Low carbon forming and deposition tendency

POWER PRESS C 150 - COMPOUNDED COMPRESSOR OILS

PERFORMANCE STANDARDS

DIN 50506

CHARACTERISTICS	POWER PRESS
	C 150
ISO VG	150
Kinematic Viscosity @ 40°C, cSt	145 - 155
Flash point, COC, °C, min	200
Pour point, °C, max	-6
CCR % Wt.	1.2
Rust test D-665 (A&B) 24 hrs	Pass

APPLICATION

- Recommended for cylinder lubrication of single and multistage air compressors handling wet gases e.g. moist air. These oils form stable emulsions with water and provide excellent lubrication of cylinder liners, piston rings and valves, etc.
- Not recommended for crankcase lubrication of compressors.

PERFORMANCE BENEFITS

- Excellent water washing resistance characteristics
- Forms soft and fluffy carbon deposits
- No adherence of carbon deposits with metal surfaces
- Provides excellent protection against rust and corrosion
- Offers extended oil drain interval

POWER PRESS 32, 46 & 68 - COMPRESSOR OILS

PERFORMANCE STANDARDS

ISO DIS-6521
DIN 51506VD-L
BIS –13256-1992

CHARACTERISTICS	POWER PRESS		
ISO VG	32	46	68
Colour	2	2.5	2.5
Kinematic Viscosity @ 40°C, cSt	29 - 35	41- 51	61 - 75
Viscosity index, min	95	95	95
Flash point, COC, °C, min	196	200	204
Pour point, °C, max	-9	-9	-9
CCR % Wt. (typical)	0.05	0.05	0.05
Rust test D-665 (A&B) 24 hrs	Pass	Pass	Pass

APPLICATION

- Recommended for lubrication of severe duty reciprocating and rotary air compressors with air discharge temperature upto 220oC.
- Suitable for lubrication of most types of OEM equipments e.g. Atlas copco, Ingersoll – Rand, ELGI etc. as product meets OEM performance requirement provided viscosity grade as recommended by OEM is selected from the range.

PERFORMANCE BENEFITS

- Good lubrication even under high operating temperature
- Excellent corrosion and rust protection characteristics
- Excellent anti wear properties offering enhanced equipment life
- Reduced fire and explosion risks due to low volatility and high auto ignition temperature
- Low carbon and deposit forming characteristics

POWER VP OILS

PERFORMANCE STANDARDS

GOST 23013 – 78

CHARACTERISTICS	POWER VP
	100
Kinematic Viscosity, cSt, @ 40°C	82
@ 50°C	47 - 58
@ 100°C	8 – 11
Viscosity index, min	95
Flash point, COC, °C, min	230
Pour point, °C, max.	-15
TAN, mg KOH/g, max.	0.1
Vapour pressure at 20°C mm of Hg. max.	1 x 10-6

APPLICATION

- POWER VP oils are recommended for high vacuum producing diffusion pumps.

PERFORMANCE BENEFITS

- Offers high oxidation resistance
- Good thermal stability
- Low chemical reactivity
- Maximum pump oil life
- Long seal life and maximum pump durability

POWER PRESS "C" OILS COMPOUNDED COMPRESSOR OILS

CHARACTERISTICS	SPECIFICATIONS		
	c -100	c -150	c- 220
ISOVG	100	150	220
Kinematic Viscosity @ 40°C, eSt	95- 105	145- 155	210- 240
Flash Point, COG,°C,·min	192	200	222
Pour Point, °C, max	-6	-6	-6
CCR% Wt.	0.7	1.2	1.4
Rust test D-665 (A&B) 24 hrs.	Pass	Pass	Pass

APPLICATION

Power press C-100 to C-220 are recommended for cylinder lubrication of single and multistage air compressors handling moist air. These oils form stable emulsions with water and provide excellent lubrication of cylinder liners, piston rings, valves, etc.

Power press "C" oils are not recommended for crankcase lubrication

PERFORMANCE BENEFITS

- Excellent resistance to washing action of water
- Forms soft and fluffy carbon deposites and has minimum tendency to adhere to metal surfaces
- Provides excellent protection against rust and corrosion

Greases

Grease is a semi solid to a solid material of dispersion of thickening agent in liquid lubricant. The thickner can be either soap or non soap. The liquid lubricant is of mineral or synthetic type. Additives are added to impart special properties.

Greases are used where it is not practical or convenient to use oil. It is used in machinery that runs intermittently or is idle for extended periods of time. It is also recommended for components that are not accessible easily for lubrication and those subjected to extreme temperature, pressure or shock loads.

POWER GEM EP 00, EP0, EP 1 & EP 2 - MULTIPURPOSE GREASE - EXTREME PRESSURE TYPE

PERFORMANCE STANDARDS

IS 7623 - 1993 (Second Revision) IPSS 1 - 09 – 005

CHARACTERISTICS	POWER GEM			
	EP00	EP0	EP1	EP2
Colour	Light Brown	Light Brown	Light Brown	Light Brown
Structure	Smooth	Smooth	Smooth	Smooth
Soap type	Lithium	Lithium	Lithium	Lithium
Base Oil viscosity @ 40°C cst, min	90	90	90	90
Penetration @ 25°C, 60 strokes	400-430	355-385	310-340	265-295
Drop Point, °C, min	170	170	180	180
Rust Test ASTM D-1743	Pass	Pass	Pass	Pass
Timken OK load, lbs, min, ASTM 2509	35	40	40	40

APPLICATION

- Recommended for both plain and anti-friction bearings in a wide variety of applications such as automotive, earth moving equipments, gear couplings, electric motors, mining equipments and general industrial machinery

PERFORMANCE BENEFITS

- Excellent shear stability High load carrying capacity High oxidation stability
- Good anti-rust & anti-corrosion properties

POWER GEM MP1, MP2 & MP3 - MULTIPURPOSE GREASES

PERFORMANCE STANDARDS

British Timken ALG 1/57
US STEEL 374
BIS 7623 - 1993 (Second Revision)
IPSS 1 - 09 - 006

CHARACTERISTICS	POWER GEM		
	MP1	MP2	MP3
Colour	Brown	Brown	Brown
Structure	Smooth	Smooth	Smooth
Soap type	Lithium	Lithium	Lithium
Base oil viscosity @ 40°C, cSt, min	90	90	90
Penetration @ 25°C, 60 strokes	310 - 340	265 - 295	220 - 250
Drop point, °C min	180	180	180
Rust test ASTM D-1743	Pass	Pass	Pass

APPLICATION

- These greases are widely accepted both for Anti-friction and Plain Bearings lubrication. These are
- Excellent greases for electric motor bearing lubrication. They are recommended for use in steel plants,
- Heavy engineering units, textile mills, process industries, petrochemicals & chemical units, etc.

PERFORMANCE BENEFITS

- Excellent water resistant properties
- Excellent shear stability
- High oxidation stability
- Superior anti-rust and anti-corrosion properties

POWER GREASE CG -60

CHARACTERISTICS	POWER GREASE CG-60
Colour	Golden yellow
Structure	Smooth
Drop point, °C Min	180
Penetration @ 25°C(worked) X60 Strokes	265 - 295
Oil separation, % (IP 121) Max	3
Rust Test (ASTM D -1743)	Pass
Heat Stability Test at 100 °C 30 Hrs % wt (Max)	3

APPLICATION

Recommended for corrosion protection of bare electrical overhead conductors in any combination of:

- Aluminium and aluminium alloy
- Steel coated with zinc (galvanised) and zinc alloy with aluminium
- Steel coated with aluminium

PERFORMANCE BENEFITS

- Good protection of conductors against corrosion
- Good water resistance
- Retains its properties throughout variable operating temperature range

POWER HI-TEMP GREASES

PERFORMANCE STANDARDS

BIS 12790 - 1989
IPSS 1 - 09 - 008
US STEEL 372

CHARACTERISTICS	POWER HI-TEMP	
	2	SUPER 2 (MOLY)
Colour	Brown	Greyish black
Structure	Smooth	Smooth
Soap type	Non-soap	Non-soap
Mineral oil % wt.	85	82
Base oil viscosity @ 100°C, cSt	30 - 35	30 - 35
Penetration @ 25°C, 60 strokes	265 - 295	265 - 295
Drop point, °C min	260	260
Rust test ASTM D-1743	Pass	Pass
Weld load, Kg, IP-239	150	230

APPLICATION

- These greases are widely accepted for use in lubrication of machine parts, plain bearings and antifriction bearings operating at high temperatures (between 120° C to 250°C).

PERFORMANCE BENEFITS

- Excellent resistance to water washout
- Do not get affected by mild acids and alkalies
- Effective lubrication under high temperature
- Hi-Temp Super 2 can also withstand shock load conditions

Rust preventive Oils

Rust preventive oils- Many of metallic parts, components and finished machines require to be protected from rust prior to further assembly or processing. Typical examples are automotive parts which require protection for a few days, weeks or month, fasteners, steel strip, steel sections, drawn sections of steel, aluminium alloy or yellow metals etc. Protective measures such as alloying, plating, painting cannot be used in such cases but requires the use of petroleum based rust preventives.

POWER RP 100 - RUST PREVENTIVE OILS

POWER RP 100 is superior non-solvent type rust preventive oil containing corrosion inhibitors and blend of highly refined base oils which offers protection to steel metals components by forming a temporary oil film.

CHARACTERISTICS	POWER RP 100
Colour (ASTM)	3
Kinematic Viscosity @ 40°C, cSt	95
Flash point, COC, °C, min	195
Film thickness in microns	15-18
Salt spray Test ASTM B117 (hrs)	40
Protection Period	Indoors - 2 / 3 months

APPLICATION

- The oil forms a soft oily film over the metal surface when applied by spraying / brushing / dipping and is recommended for protection of work piece against rusting for short duration indoor and outdoor storage. It is ideally suited for the rust protection of steel sheets during storage and transportation.
- Also suited for internal protection of gearboxes. The oil film can be removed easily by wiping or with the help of a petroleum solvent.

PERFORMANCE BENEFITS

- Good rust protection indoor and outdoor
- Easy removal of film
- Cost effective due to better coverage

POWER RP LIGHT - NON-SOLVENT TYPE RUST PREVENTIVE OILS

POWER RP LIGHT is superior non-solvent type rust preventive oil fortified with additive, which offer a good rust protection.

CHARACTERISTICS	POWER RP LIGHT
Colour (ASTM)	5
Kinematic Viscosity @ 40°C, cSt	7.0 – 10.0
Flash point, COC, °C, min	140
Salt spray test – ASTM B-117 Hrs	35
Film Thickness in Micron	4.0 – 5.0

APPLICATION

- The oil forms a soft oily film over the metal surface when applied by spraying / brushing / dipping and is recommended for protection of work piece against rusting for short duration indoor storage. The oil film can be removed easily by wiping or with the help of a petroleum solvent.

PERFORMANCE BENEFITS

- Good rust protection when stored indoor
- Easy removal of film

POWER RP 150DW - RUST PREVENTIVE OILS

PROTECTION OF TREATED PARTS

Indoors - 3 to 6 months
Outdoors - 1 to 2 months

CHARACTERISTICS	POWER RP 150DW
Appearance	Clear brown liquid
Specific gravity @ 29.5°C	0.82 – 0.85
Type of film	Oily, smooth
Flash point COC, °C, min	40
Film Thickness (microns)	4.5
Salt Spray Test – ASTM B-117(Hrs)	72
Water displacement test (as per IS 1154)	Pass
Coverage (Sq.mt/Ltr)	40-50
Protection	
a) Indoors	3 -6 Months
b) Out doors	1-2 Months

APPLICATION

- POWER RP DW-150 is recommended for protection of parts coming from machines using water-soluble oils and synthetic oils as coolants.
- Also recommended for industries manufacturing nuts, bolts, HSS bearings, Steel tubes, bars, tool-bits, tools and other small components for in-process protection.

PERFORMANCE BENEFITS

- Effective and efficient corrosion protection (to small cast iron parts also)
- Cost effective due to high coverage
- Easy removal of film with kerosene or any other petroleum solvent

Auto Gear Oils

POWER AUTO TRANSMISSION FLUID A

PERFORMANCE STANDARDS

General Motors Type A Suffix A.
TES – 122 of Detroit Diesel Allison
TEML 03 of ZF, Germany
DBL-6623-10 of Daimler Benz, Germany

CHARACTERISTICS	POWER AUTO TRANSMISSION FLUID A
Kinematic Viscosity @ 100°C, cSt	7.4 – 7.9
Viscosity index, min	160
Flash point, COC, °C, min	180
Pour point, °C, max	(-) 39

APPLICATION

- POWER AUTO TRANSMISSION FLUID A is recommended for automotive transmission and power steering units of automobiles and light trucks requiring Type A Suffix A fluids and also synchromesh gears.

PERFORMANCE BENEFITS

- Compatible with all types of seal materials
- Suitable for all seasons
- High oxidation stability
- Long service life
- Good anti-wear and anti-corrosive properties
- Good anti-foam characteristics

POWER GEAR EP 80W - EXTREME PRESSURE GEAR OILS

PERFORMANCE STANDARDS

BIS: 1118 – 1992 EP type
API Service Classification GL-5 level
U.S. Military MIL-L-2105 D

CHARACTERISTICS	POWER EP
SAE No	80W
Kinematic Viscosity @ 100°C, cSt	8 – 10
Viscosity index, min	90
Flash point, COC, °C, min.	180

APPLICATION

- Recommended for use in gearboxes and rear axles where extreme pressure properties are required particularly for hypoid and bevel gears.
- Not recommended for industrial gears having copper or copper alloy parts.

POWER GEAR EP 80W90 - EXTREME PRESSURE GEAR OILS

PERFORMANCE STANDARDS

API Service Classification GL-5 Level
U.S. Military MIL - L - 2105 D

CHARACTERISTICS	POWER GEAR EP 80W90
Kinematic viscosity @ 100°C, cSt	14 - 17
Viscosity index, min	90
Pour Point Deg C (Max)	-27
Flash point, COC, °C, min.	165

APPLICATION

This oil is recommended for vehicles operating in areas where ambient temperatures vary widely and expected to give fuel economy.

PERFORMANCE BENEFITS

- Multipurpose Lubricant
- Excellent anti-rust characteristics.
- Excellent anti-wear properties
- Excellent anti-foam properties.

POWER GEAR HP 90 & 140 - AUTOMOTIVE HYPOID GEAR OILS

POWER GEAR HP oils are extreme pressure multipurpose gear oils formulated from solvent refined high viscosity index base stocks and selected additives.

PERFORMANCE STANDARDS

BIS: 1118 – 1992 EP type
API Service Classification GL-4 level
U.S. Military MIL-L-2105
UK Defence CS 3000A Specifications

CHARACTERISTICS	POWER GEAR HP	
SAE No.	90	140
Kinematic Viscosity @ 100°C, cSt	16- 18	28- 34
Viscosity index, min	90	90
Flash point, COC, °C, min.	180	190
Pour Point, °C	-9	0
Channel Point, oC (typical)	-18	-7

APPLICATION

- Recommended for use in gearboxes and rear axles where extreme pressure properties are required particularly for hypoid and bevel gears.
- Not recommended for industrial gears having copper or copper alloy parts.

PERFORMANCE BENEFITS

- Excellent anti-rust characteristics
- Excellent anti-wear properties
- Excellent anti-foam properties

POWER TRANSMISSION FLUID F10 - TRANSMISSION FLUID

PERFORMANCE STANDARDS

Ford ESW-M2C-33F

CHARACTERISTICS	POWER TRANSMISSION FLUID F10
SAE	10
Colour	Red
Kinematic Viscosity @ 100°C, cSt	7.2 – 7.8
Viscosity index, min	150
Flash point, COC, °C, min	180
Pour point, °C, max	(-) 39

APPLICATION

- POWER TRANSMISSION FLUID F10 is suitable for applications requiring transmission fluid meeting Ford ESW-M2C-33F specification.

PERFORMANCE BENEFITS

- Compatible with all types of rubber seal materials
- Suitable for all seasons
- High oxidation stability
- Long service life
- Good anti-wear and anti-corrosive properties
- Good anti-foam characteristics
- Ensures excellent shit feel
- Reduces maintenance cost due to prevention of transmission damage
- Prevents wear of gear pumps and other parts

POWER TRANSMISSION FUIDS C4

PERFORMANCE STANDARDS

Meets TES 228 of Allision division of GM, USA. - Approval no. C4 – 29780 04

CHARACTERISTICS	POWER TRANSMISSION C4	
SAE Grade	IOW	30
Kinematic viscosity @ 100°C, eSt	5.6	9.3- 12.3
Viscosity index, min	100	100
Flash point, °C (PM closed), min	165	200
Pour point, °C, max	-30	-18
TBN mgKOH/g Min	7	7

PERFORMANCE BENEFITS

- Better oxidation stability because of hydrotreated base stocks resulting into lower sludge and varnish formation.
- Meet Superior non-asbestos clutch friction tests
- Better anti-foam, antirust properties
- Longer drain period.
- Provides excellent seal compatibility due to its
- Refined base stocks.

POWERSPIN - SUPERIOR SPINDLE OILS

PERFORMANCE STANDARDS

BIS: 493 (Part II) 1981

CHARACTERISTICS	POWERSPIN	
ISO VG	15	22
Colour (ASTM)	1.5	1.5
Kinematic Viscosity @ 40°C, cSt	13-16	20-22
Flash point, COC, °C, min.	140	170
Pour point, °C, max.	-3	0
Rust test (D-665)	Pass	Pass

APPLICATION

- Recommended for bearing lubrication of high-speed textile and machine tool spindles, timing gears, centrifugal separators, positive displacement blowers and hydraulic systems of certain high precision machine tools.
- Power Spin 22 is also recommended as anti wear hydraulic oil for systems requiring low viscosity hydraulic fluid.

PERFORMANCE BENEFITS

- Excellent resistance to rust and corrosion
- Excellent thermal and chemical stability
- Lowest fluid friction
- Excellent anti-wear characteristics of Power Spin 22

Cylender Oils

POWER CYL 460 & 680 - CYLINDER OIL

POWERCYL oils are straight cylinder oils manufactured from premium performance cylinder oil base stocks. These oils have good film strength and thermal degradation characteristics.

PERFORMANCE STANDARDS

BIS 2297 - 1997

CHARACTERCISTICS	POWER CYL	
ISO VG	460	680
Kinematic Viscosity, cSt @ 40°C	420 - 480	640-680
@ 100°C	28 - 32	---
Viscosity Index, min	90	85
Flash point, COC, °C, min	280	280
Pour point, °C, max	0	0

APPLICATION

- Recommended for lubrication of cylinders of steam engines.
- Ideal product for lubrication of heavily loaded slow speed worm gears.
- Recommended for lubrication of paper and textile mill calendar bearings and sugar mill roller bearings

PERFORMANCE BENEFITS

- Enables higher loading of equipment due to its high load carrying ability
- Reduces wear of cylinder walls and piston rings
- Good corrosion and rust protection
- Reduces deposit formation at high temperatures
- Excellent adhesive property, which helps to resist water washing

POWER CYL C460 - CYLINDER OIL

POWERCYL C460 is highly refined steam cylinder oil compounded with specially selected additives to make it withstand high temperature. This oil has excellent oiliness, good film strength characteristics and effective resistance to water wash out and thermal degradation.

PERFORMANCE STANDARDS

BIS: 1589-1966 Grade 1 Type 2

CHARACTERCISTICS	POWER CYL C
ISO VG	460
Kinematic Viscosity, cSt @ 40°C	460 - 480
Viscosity Index, min	90
Flash point, COC, °C, min	280
Pour point, °C, max	0
CCR, % Wt. max.	2.5

APPLICATION

- Suitable for lubrication of worm gears.
- Also recommended for lubrication of steam cylinder under wet saturated steam conditions.
- Ideal for application in lubrication of paper and textile mill calendar bearings and sugar mill roller
- bearings, aluminium wire drawing industry etc.
- Not suitable for systems where steam condensate is reused by mixing with boiler fed water.

PERFORMANCE BENEFITS

- Enable higher loading of equipment due to their high load carrying ability
- Reduce wear of cylinder walls and piston rings
- Good corrosion and rust protection
- Resist scouring action of steam
- Reduce deposit formation at high temperature
- Excellent adhesive property, which helps to resist water washing

POWER WAYLUBE - SUPERIOR MACHINE TOOL WAY OILS

POWER WAYLUBE oils as name suggests are conventional superior performance machine tool way lubricants formulated from highly refined base stocks and fortified with anti-rust, tackiness and mild EP additives.

PERFORMANCE STANDARDS

ASLE standard W 315 and W 1000
Cincinnati Milacron specifications, P-47 and P-50

CHARACTERISTICS	POWER WAYLUBE	
ISO VG	68	220
Kinematic Viscosity @ 40°C, cSt	61-75	198-242
Flash point, COC, °C, min	170	192
Pour point, °C, max	-6	-3
Rust test (D-665A, 24 hrs)	Pass	Pass

APPLICATION

- Recommended for slideway lubrication of grinders, planers, shapers, horizontal boring machines, knitting machines, jig bores, etc. involving high precision work.

PERFORMANCE BENEFITS

- Excellent lubrication characteristics
- Minimise stick-slip and chatter, thereby giving improved surface finish to the job
- Reduce oil consumption, due to good adhesive characteristics of the oil
- Provide protection from rust and corrosion
- Permit higher loading of machine tools

POWER GLASS MOULD OILS

POWER GLASS MOULD 5 is manufactured from specially selected Base oils and additives depending on the application.

CHARACTERISTICS	POWER GLASS MOULD 5
Colour	L 0.5
Kinematic Viscosity, cSt @ 40°C	4.2 - 5.0
@ 100°C	--
Flash point, COC, °C min.	130

APPLICATION

- POWER GLASS MOULD OILS are designed to give best performance as a mould release agent. The product does not leave residue and does not fume during spraying. It can be applied on the mould by spraying or swab.

PERFORMANCE BENEFITS

- Good mould releasing characteristics
- No residues left on the mould
- Low volatility

POWER MOULD 22 - MOULD RELEASE OIL

POWER MOULD 22 is concrete mould release oil manufactured from refined petroleum product and fortified with special additives to impart good surface finish to the moulded product.

CHARACTERISTICS	POWER MOULD 22
ISO VG	22
Kinematic Viscosity @ 40°C, cSt	20 - 24
Flash point (PMCC), °C, min	125
Pour point, °C, max	-12
Saponification value	8

APPLICATION

- Recommended for use as mould release oils during production of concrete sleepers, spun pipes and other moulded products.
- The product can also be applied by Aerosol system.

PERFORMANCE BENEFITS

- Excellent demoulding characteristics with good surface finish
- Non-toxic

POWER SHUTTERING FLUID 8

Power Shuttering Fluid 8 is excellent shuttering oil specially formulated for the construction industry, which provides good surface finish to the concrete.

CHARACTERISTICS	POWER SHUTTERING FLUID 8
Density @ 29.5°C.	0.82
Sprayability	Very good

** Fresh coating of Power Shuttering Fluid should be protected from rain.*

APPLICATION

- Recommended for use in the production of concrete sleepers and mould releasing of concrete structurals.

PERFORMANCE BENEFITS

- Excellent mould releasing characteristics with good surface finish
- Non-toxic
- Increased wooden plank life /metal shutter life

COVERAGE

- Timber: 20 sq.mtrs. / liter
- Steel / plastic: 40 – 50 sq.mtrs. / liter

Hydraulic Oils

Q: What properties need to be considered while selecting Hydraulic fluids?

A: -When Selecting Hydraulic fluids for a particular application a number of properties may need to be considered. Viz - Viscosity, Lubricity & wear reduction, Oxidation stability, Corrosion protection, air & water separation characteristics, bulk modulus (resistance to compression), Pour point &flash point

Q: How many types of Hydraulic fluids available in the market?

A: There are two general types:

- for Mobile Hydraulics (Excavators, dumpers, trucks, etc) and,
- Industrial Hydraulic equipments

such fluids include:

- General purpose R & O type
- Antiwar Hydraulic fluids
- Fire resistance Fluids

Each Hydraulic pump manufacturer has its own performance requirements. There are also industry Standards that define the basic performance standards

Q: What are the main functions of Hydraulic oils?

A: The main functions of Hydraulic Oils are

- Transmit Power
- Lubricate & protect system components to minimize friction & wear
- Carry away heat in the system
- Provide Sealing & maintain System Pressure
- Prevent rust and corrosion

Q: What is the main difference between circulating oil & Hydraulic oils?

A: A typical system for circulating requires oil for bearing lubrication & to remove heat through circulation and these oils do not contain any anti wear additives. However in case of Hydraulic oils the system demands more severe performance of protecting moving parts of pumps and valves which are operating under much higher pressure. Hence these hydraulic oils must contain anti wear additives.

Q: why viscosity is very important criterion in the selection of Hydraulic fluids?

A: Because at low temperature, excessive (higher) viscosity may result in poor mechanical efficiency, difficulty in starting, and lead to wear. As oil temperature increases viscosity decreases, resulting in lower volumetric efficiency, overheating and wear. Therefore the pump & motor manufactures often provide recommendation for:

- the maximum start up viscosity
- maximum & Minimum operating temperature
- The range of operating viscosity.

Selection of the optimum fluid viscosity grade will provide the most efficient pump performance at standard operating temperatures.

Q: What is the major cause of component failure in Hydraulic Systems?

A: Oil contamination. Independent tests have shown that up to 70% of failures in hydraulic systems are caused by contaminated fluids.

Q: How often should hydraulic fluids be changed?

A: fluid Samples should be sent to specialised fluid Testing Lab on regular basis and renewed on the laboratories recommendations.

Q: What is the recommended flow rate for the side filtration pump?

A: Normally 10% of the reservoirs capacity in litres/minutes (e.g. 200 litres reservoir with a 20 lit/min side filtration pump) .If Servo or proportional valves are used; the side filtration must be at least 20% of the reservoir capacity in Lit/Min.

Q: Is it advisable to mix hydraulic oils of two different brands?

A: It is recommended that Fresh Hydraulic oils of same viscometrics can be mixed without any problems .However topping up with the another brand in a used oils need to be checked for the compatibility study before mixing

Recommended Steps to maintain a clean Hydraulic Systems:

- Do not expose the hydraulic system to dirty environment
- When adding clean oil ensure the container, funnel, pump & area around the reservoir is clean
- Don't allow /tolerate hydraulic leak. Repair them ASAP
- Change hydraulic filters at manufacturers recommended intervals
- Have an oil analysis performed on your oil every two years or whenever you suspect a contamination problem
- Keep oil level up in hydraulic reservoir
- Don't mix different oil bases. Ensure when adding oil that it is compatible with the oil currently in the system.

- Do not allow the oil to reach extreme temperature – 90-100 deg C

Thermic Fluids

Q: When should we clean our system?

A: Check for following:

- Check oil for Viscosity - carbonization. In case of viscous oil - clean the system.
- If fuel consumption is increased unnaturally - clean the system.
- If you are unable to get the temperature - clean the system.
- When you are entirely changing the oil - clean the system. Normally we change oil when it has gone bad, carbonized. Low flash point, high level of high boilers, more ash content, acidity etc. is the indication of oil going bad. So we need to clean the system to avoid new oil going bad again.
- If total ash content in the oil is @ 2-3 % - clean the system (Take sample of oil in a dish, increase oil temperature to convert it into ash & measure ash content.)

Q: Why should we clean our system?

A: Deterioration of Thermic Fluid: Thermic fluid when used continuously eteriorates & needs replacement. The main causes of deterioration are:

- Contamination
- Oxidation
- Cracking

Let us look at these causes more closely:

1) Contamination: Contamination of thermic fluid can be due to:

a) With Process Products. It can occur with the material during processing. The process materials have different temperature characteristics compared to thermic fluids. When mixed with thermic fluid, these materials decompose or get burn out, having deposits on the heating surface. Such deposits cause overheating - create hot spots - thus further degrades thermic fluid.

b) Contamination with water is problematic on two grounds:

(i) It forms emulsions with oil. This not only reduces life of the oil but also induces corrosion of the system internals.

(ii) Water forms steam at normal system working temperature, thus pushing hot thermic fluid out of system.

c) Rust, dirt, pipe-seals: These infiltrate the system during construction, gets

loosened during normal system run. Installation of side stream filter can solve this problem.

d) Contamination due to mixing of thermic fluids: Many thermic fluids are not chemically compatible with each other. Contamination can occur if the compatibility is in question. Any change in thermic fluid or top up with another thermic fluid should be avoided or thoroughly evaluated.

In short, contaminants can be listed as:

- Leakages of process products through pipe lines, vessels etc.
- Water
- Corrosion products, seals, dirt, dust etc.
- Mixing of different thermic fluids.

II) Oxidation: Thermic fluid at high temperatures, get oxidized & form carbonaceous, gummy deposits which impair system effectiveness & performance, by clogging pump filters, hamper heat transfer rate etc. Oxidation of thermic fluid produces acidic products, which are soluble in oil along with insoluble sludge and gummy deposits, which increases viscosity of oil. The acidity will increase rate of corrosion of internals. Hence properly designed expansion cum deaeration tank will be useful to remove low boilers or reaction of Thermic fluid with air.

III) Cracking: Cracking is the result of insufficient circulation of thermic fluid at optimum velocity resulting in overheating of thermic fluid. This results in breaking of long chains into smaller chain compounds, increases suspended solids such as ash, carbon percent etc. This induces hot spots on pipe internals, which increases localized heating of oil film, which is much above the cracking temperature. Cracking results in the release of higher inflammable hydrocarbons, reducing viscosity & flash point of thermic fluid. Unstable hydrocarbons will polymerize and form deposits. These deposits will reduce heat transfer rate of overall system, reduction of flash point thus serves as a warning indicating that cracking has started.

Following are the consequences when oil goes bad:

Consequences of contaminations on system are:

- Reduction in heat transfer rate.
- Lower fuel efficiency.
- Difficulty in start up at low temperatures.
- Flow restriction in small diameter pipelines or in low velocity areas; thus increases in Pumping cost. 5) Fouling of heat transfer surfaces.
- Failure of heater coils.
- More maintenance cost.
- Reduction in overall system efficiency.
- Reduction in life expectancy of thermic fluid, heater oil.
- Pump cavitations.

Consequences of contaminatioins on oil are:

- Increase in viscosity.
- Reduction in flash point.
- Darker color.
- Increase in acidity.
- Formation of sludge.
- Lowering of boiling point & increase in vapours pressure.
- Overall reduction in life.

Q: how to clean thermic fluid system?

A: We have seen that deteriorating of thermic fluid is due to contamination, oxidation or overheating, cracking. This can lead to partial or full choking of the thermic fluid system. This would call for cleaning, decarbonizing of thermic fluid system. Apart from this if you are changing the entire thermic fluid of the system then the cleaning & decarbonization of the system is recommended. Criticality in decarbonising is, carbon does not dissolve into any chemical. It needs to be broken into finer particles and brought into flowable condition. Baked carbon forms bond with the metal and is difficult to remove by ordinary chemicals / detergents.

There are basically two methods for cleaning of system:

- Water based
- Oil based

WATER BASED CLEANING: The total time required for cleaning the system and put it into operation can vary between a few days to few weeks. In case of water based cleaning system the time is higher because entire quantity of water should be drained out of system otherwise that water will pose three problems:

- It forms unstable emulsions with oil, which will reduce the life of oil.
- It induces internal corrosion of the system. The corroded areas provide anchorage for depositions.
- Once heated water changes to steam, overpaying more volume and pushing hot
- thermic fluid out of the system, which is a safety hazard.

OIL BASED CLEANING: Oil based chemicals clean and decarbonise the entire system using old thermic fluid only. Even some other waste oils can be utilized as media such as transformer oil, vacuum pump oil etc. There is no time delay or safety hazard for start up of the system. Some traces will not have any adverse effect on system. They will vent off once the system is commissioned.

Metal working oils

Q: How do I mix a water extendable coolant?

- Both, water and concentrate should be at room temperature. Big differences in temperature lead to instability of the resulting mix.
- The coolant concentrate must be added to the water while continually stirring, never visa versa.
- The use of an automatic mixer is strongly recommended.

Q: What are possible reasons for foam problems with water soluble coolants?

- The emulsion is instable due to incorrect mixing or from bacterial attack.
- The coolant sump is too small or not filled to an appropriate level, giving the entrapped air not enough time to dissipate.
- The pump is sucking air - cavitating.
- The concentration is too high.
- Contamination with surfactants, e.g. from machine cleaners.
- Incorrect product selection for the existing water quality.

Q: Why do emulsions sometimes have a “Monday Morning Smell” ?

The “Monday Morning Smell” is caused by microbial attack of the emulsion by bacteria, yeast and fungi. Reasons for the attack are:

- Reduced biostability due to low concentration.
- Tramp oil on the surface of the emulsion and poor aeration promote the growth of anaerobic bacteria.
- Instable emulsions (see item 1) have low bio resistance.
- The mixing water has microbial contamination.
- The machines and systems have not been cleaned before the refill.

Q: Why can water solubles loose their corrosion protection performance?

- The concentration is too low.
- Salts accumulate due to top up with hard water.
- The emulsion is unstable due to wrong mixing.
- The pH has fallen due to biological attack.
- Tramp oil may give the wrong concentration readings.

Q: What are emulsifiers?

A: Emulsifiers are chemical molecules which allow the stable distribution of oil droplets in water. There are 3 main groups which can be classified by their polarity:

- Anionic (Potassium or Sodium soaps, Amine compounds and Sulphonates)
- Nonionic (Ethoxylated fatty alcohols, fatty acids and fatty amides)

- Cationic (Quaternary Ammonium Compounds) are rarely used in water soluble coolants.

Q: Is there a fire risk associated with the use of neat cutting oils?

Yes. All mineral oils, as well as vegetable oils or esters, have an explosion range. For Mineral oils it is commonly between 0.6 and 6.5 vol%. Within this explosion range there is a danger of explosion if there are ignition sources as e.g. broken tools. The mix of oil and air in a machine tool should be kept either below 0.6 vol% by using local exhaust ventilation (LEV) units or above the upper explosion limit by heavy flooding. As the flashpoint of neat cutting oils is mostly far above 100 °C, this value has usually smaller impact when fire occurs.

Q: When do you use water solubles and when the neat cutting oils?

- Water soluble coolants have the 4 times higher cooling power compared to neat oils and are used, when cooling is the major demand.
- Neat oils have the advantage of higher lubrication power.

Q: What are the advantages using ester- or vegetable oils?

- The high polarity of these products allows high wetting of the cutting zone and gives excellent lubrication.
- Comparing to mineral oils of similar viscosity they have much smaller tendency to create oil mist and vapour. This results in lower consumption and a cleaner working environment.
- Their composition is similar to the protective layer of the skin, therefore they have better compatibility than mineral oil.
- They are produced from renewable material and are therefore more environmental friendly.

Q: What are multi functional oils?

- Multi functional oils are coolants. The coolant concentrate is also suitable for hydraulic, spindle and slideway lubrication.
- Multi functional oils can be used undiluted or as water soluble coolant.
- Contamination of the coolant by “tramp oils” are no longer a problem.

Q: Which are the 5 main factors that influence the performance of a soluble oil?

- The water quality
- Tramp oil
- Microbiological attack (bacteria, yeast, fungi)
- Chemical reaction with the machined material
- The temperature being too high or too low

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