Lubricating materials for Continuous Casting Machines

OILS
GREASES
Special products
LUBRICATING MATERIALS
For Continuous Casting Machines

1. Rotary table
   Universal: Sliding GR
   Extended service life:
   SKS-300m; Molyroll GR; Agrinol Termostan

2. Mold
   Separation oil: Form Divider

3. Bearings of roller bed
   Universal: Sliding GR
   Water-resistant: SKS-300m
   Extended service life:
   SKS-300m; Molyroll GR; Agrinol Termostan

4. Bearings of roller sections
   Universal: Sliding GR
   Water-resistant: SKS-300m
   Extended service life: SKS-300m; Molyroll GR; Agrinol Termostan

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**LUBRICATING MATERIALS**
*For Continuous Casting Machines*

5. **Reducers, oil reservoir, circulation lubrication systems**
   - Universal: Highrate XP, Special Oil ART
   - Circulation general-duty systems: Hydroil HM, Agrinol TP

6. **Centralized lubrication system**
   - Universal: Sliding GR
   - High temperature with improved performance: SKS-300m;

7. **Hydraulic system**
   - Universal: Hydroil HM, Hydroil HM 46, Agrinol
   - Hydraulic Lift
   - Significant unit: Hydroil Ultra HM

8. **Drive clutches**
   - Greases: Sliding GR, Molyroll GR, Oils (oil mist) Highrate XP, Special Oil ART

9. **General purpose greases**
   - High temperature: SKS-300m
   - For electromotor: Sliding GR

**Auxiliary systems**
- Transformers: Agrinol GK; T-1500
- Pumps: Sliding GR grease; Hydroil HM, Hydroil Ultra HM oils
- Plain slideway: Agrinol INSp
- Pilot line: Hydroil HM

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LIFTING ROTARY TABLE for casting ladles of continuous casting machines consist of base, rotary platform, cross transfer table, rotary mechanism, support frame with traverses for casting ladles and up-down mechanism of ladles.

CARTS (lifting rotary tables of tundishes) serve for fast tundish replacement during the metal casting by «melting on melting» method.

TUNDISHES ensure regulated rate of steel feeding to the mold and steel distribution between molds in case of multi-grooved casting, and for metalworking outside the furnace (modification, adjusting the chemical composition of metal, etc.).

HOW IT WORKS:
The platform rotates on rollers that are concluded to ring and are located between bearing ring on the platform and a circular rail on the base. The platform rotation is carried out by two electric motors through the helical and bevel gear.

PERFORMANCE FEATURES of OPERATION UNITS:
- Low speeds;
- High impact loads;
- Overturning torques;
- High temperatures.

RECOMMENDED GREASES:
- SKS 300 m-2
- Sliding GR 2

RECOMMENDED OILS:
- Highrate XP,
- Special Oil ART
- Hydroil HM (Ultra)
MOLD is a water-cooled form for speeding solidification of liquid metal. Molds are equipped with sliding mechanisms to provide them with reciprocating or back-rotary motion.

WITHDRAWAL STRAIGHTENING MACHINE is intended for casting pulling from the mold, straightening curved casting into a straight-line one and its submission to the dividing shears.

Withdrawal straightening rolls give out the billet to the roller bed, where it is sliced into measured lengths by the gas cutting machine (or shears).

On vertical CCM the drive shafts make a billet move. On radial CCM a withdrawal straightening system consist of gear roller strands.

**PERFORMANCE FEATURES of OPERATION UNITS:**
- Low speeds;
- High loads;
- Water contact;
- High temperatures;

**SEPARATION OIL:** Form Divider

**RECOMMENDED GREASES:** SKS 300 m-2
Sliding GR 2

**RECOMMENDED OILS:** Highrate XP,
Special Oil ART
Hydroil HM (Ultra)
SECONDARY COOLING ZONE (ROLLER SECTIONS and ROLLERS)
Secondary cooling zone consists of roller sections. Section rollers are installed with the different rate that is increasing during the technological channel. Secondary cooling zone equipment is intended for retaining of ingot with a liquid core from metal shell bulging, ingot casting to horizontal position, its straightening from the mold and cooling. Sections consist of the upper and lower frames fitted with the rollers.

ROLLER BEDS
Drive roller beds or rolling conveyors for horizontal or inclined movement of billets that can be rolled on rollers. During the transportation on conveyor the billets move on stationary rollers (axes are fixed to the conveyor frame).

SHEARS are intended for separation of continuous casting billets into measured lengths. Currently the gas cutting devices and shears are used.

PERFORMANCE FEATURES of OPERATION UNITS:
- Low speeds;
- High loads;
- Water contact;
- High temperatures;

RECOMMENDED GREASES:
- SKS 300 m-2
- Sliding GR 2
- Highrite XP
- Special Oil ART
- Hydroil HM (Ultra)
LUBRICATING MATERIALS
For ROLLING MILLS

HOT ROLLING
Hot rolling is carried out at the temperature that is higher than the recrystallization temperature of rolling material. Depending on the final product, the rolling mills consider a heavy plate, hot, structural, shaped or strand rolling.

COLD ROLLING
During the cold rolling, steel strap is usually formed without preheating. Comparing to hot rolling, better dimensional accuracy, surface cleanliness, and lower strap thickness are achieved.

PERFORMANCE FEATURES of OPERATION UNITS:
• Low speeds;
• Extreme loads;
• High temperatures.

RECOMMENDED GREASES:
SKS 300 m, Sliding GR
Rolling GR

RECOMMENDED OILS:
Highrate XP, Special Oil ART
Hydroil HM (Ultra), Agrinol I-HG-B

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INDUSTRIAL GLEASES

SKS 300 m-1, m-1*
SKS 300 m-2, m-2*
Ca Sulfonate

Multi-purpose, heat-resistant, water-resistant greases for lubrication of bearings and other friction units of different equipment for steel industry that operates under extreme loads, high temperatures and water contact.

SKS 300 m-1, SKS 300 m-1* (NLGI 1/2): for centralized greasing systems and devices of the forced feed lubrication of friction units.
SKS 300 m-2, SKS 300 m-2* (NLGI 2): for embedded greasing of bearings.

* - only grease color is different (red).

INDUSTRIAL TESTS:

1. Bearings tests on CCM rollers together with specialists have not defined any damages because of mechanical wear, water contact and high temperature.
2. Bearings are allowed to be reused. Technical properties of SKS 300m grease allowed to extend the range of application objects as bearing units of rolls of sheet mills.
3. Grease has retained its plasticity and consistency after the wasted period.
4. No leakage because of the high temperature.
5. No washout or emulsification in the area of water contact.

1. 100% of all bearings are lubricated according to required quantities.
2. Grease pumpability through the units of feeders, highways and central station equipment is provided.
According to conclusions of Ukrainian R&D center of hemmotology and certifications of fuels, lubricants and technical liquids and UkrNDINP "Masma" about the main physical and chemical quality properties that determine the performance features of greases

SKS-300m is not worse and even exceeds TOTAL CERAN HV grease on some parameters.
## COMPARISON of ANTI-WEAR PROPERTIES of INDUSTRIAL GREASES

### COMPERATIVE CHARACTERISTIC of INDUSTRIAL GREASES

#### ANTI-WEAR PROPERTIES

<table>
<thead>
<tr>
<th>Thickener</th>
<th>Welding load, (Pc), H(кГс)</th>
<th>Application temperature, °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrinol SLIDING GR</td>
<td>Li Complex + EP</td>
<td>3283</td>
</tr>
<tr>
<td>Shell ALVANIA EP (LF)</td>
<td>Li + EP</td>
<td>2323*</td>
</tr>
<tr>
<td>SKF LGEP 2</td>
<td>Li + EP</td>
<td>2800*</td>
</tr>
<tr>
<td>Mobil Mobilux EP</td>
<td>Li + EP</td>
<td>2500*</td>
</tr>
<tr>
<td>Agrinol SKS 300m</td>
<td>Ca Sulfonate</td>
<td>4136 (5800*)</td>
</tr>
<tr>
<td>TOTAL CERAN HV</td>
<td>Ca Sulfonate</td>
<td>3920*</td>
</tr>
</tbody>
</table>

*Tipical properties*
**APPROVALS and LABORATORY TESTS**

**INDUSTRIAL GREASE «SKS 300 m»**

**SKS 300 m** grease was tested in laboratories:

- **BFB Oil Research S.A. (Belgium)**
- **Ukrainian R&D center of hemmotology and certifications of fuels, lubricants and technical liquids (Ukraine)**
- **UkrNDINP "Masma" (Ukraine)**

**MIXTURE TESTS**

According to conclusions of Ukrainian R&D center of hemmotology and certifications of fuels, lubricants and technical liquids and UkrNDINP "Masma" about the main physical and chemical quality properties that determine the performance features of greases:

SKS-300m is not worse and even exceeds TOTAL CERAN HV grease on some parameters.
**INDUSTRIAL GREASES**

<table>
<thead>
<tr>
<th>Sliding GR 00</th>
<th>Sliding GR 0</th>
<th>Sliding GR 1</th>
<th>Sliding GR 2</th>
<th>Li Complex +EP</th>
</tr>
</thead>
</table>

**UNIVERSAL greases** for lubrication of sliding bearings rolls of rolling mills, heavy loaded ball and roller bearings, heavy loaded gears and other industrial equipment units.

- **Sliding GR 00 (NLGI 00)**
- **Sliding GR 0 (NLGI 0)**

are the liquid greases for all kind toothed and helical gears and for centralized greasing systems also.

- **Sliding GR 1 (NLGI 1)** is a winter grease for centralized greasing systems.
- **Sliding GR 2 (NLGI 2)** is a summer grease that is used as an embedded one.

As an alternative for GEAR GREASES of Transol type the following new greases are designed:

- **Sliding GR 00 (NLGI 00)**
- **Sliding GR 0 (NLGI 0)** Lithium complex greases with anti-scuff and anti-wear (EP) additives;

Liquid greases intended for toothed and helical gears of all units, and for centralized greasing systems also.
**«SLIDING GR» GREASE INDUSTRIAL TESTS**

**SLIDING GR** Grease  
Was tested on Tube Assemblies-30-102 of ‘Interpipe NIKO TUBE’

The first grease filling = 30kg.  
Uniol-2M (Ca-Complex) grease requires 39kg pumping between fillings.  
Each succeeding filling of Uniol-2M grease = 30kg.

**SLIDING GR** grease does not require pumping between fillings.  
Each succeeding tab does not exceed 1/3 of the first tab V.

<table>
<thead>
<tr>
<th>Operation time, days</th>
<th>Total grease consumption, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>105</td>
<td>105</td>
</tr>
</tbody>
</table>

According to pilot industrial test results the lubricant consumption of «SLIDING GR» grease is 4 times less comparing to UNIOL 2M grease that is used; in a monetary value it makes around 20% savings for customer.
Uniol-2M grease: pumping every 40 minutes.

SLIDING GR grease: pumping every 2 hours.

Grease consumption for manufacturing of 1000 tons of pipes

According to industrial test results the lubricant consumption of «SLIDING GR» grease is 3 times less comparing to UNIOL 2M grease that is used. Economy for manufacturing of 1000 tons of pipes is 57 kg (2 times less).
SLIDING GR grease is tested in T-3 workshop of JSC Sinarsky Pipe Works

According to industrial test results the lubricant consumption of «SLIDING GR» grease decreased 2.78 times compared to UNIOL 2M grease in a period of 11.09 – 17.10. 2012

<table>
<thead>
<tr>
<th>Operation</th>
<th>Consumption, kg</th>
<th>Grease saving, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease consumption by direct pumping during the operation between transshipments</td>
<td>0</td>
<td>5,4</td>
</tr>
<tr>
<td>Grease pumping in servicing between transshipments.</td>
<td>12</td>
<td>28</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
<td><strong>33,4</strong></td>
</tr>
</tbody>
</table>

**SLIDING GR** grease does not require pumping between fillings.
Tested SLIDING GR grease is successfully applying:
- In thin sheet workshop-2 (mill 3000) PJSC Alchevsk Iron & Steel Works on the drive shaft bearings of mill stands.
Is recommended for application in hot sectors of thin sheet workshop-2 (mill 3000) (heating furnaces area, shelf stand refrigerator №1).

- PJSC "AZOVSTAL IRON & STEEL WORKS"
Grease consumption was halved, SLIDING GR grease operates for 8-10 campaigns. Service life of bearings increased up to 3 years.
**INDUSTRIAL GREASES**

<table>
<thead>
<tr>
<th>Rolling GR S</th>
<th>Rolling GR W</th>
<th>Ca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolling GR industrial grease is intended for lubrication of the different friction units: sliding and rolling bearings of the industrial, building, mining, metallurgical equipment, hinges, screw and chain transmissions, agricultural gears, road-constructing and transport machines with повышенными requirements to mechanical and thermal stability at high loads.</td>
<td>Rolling GR W (NLGI 1) is a winter grease for centralized systems of continuous greasing</td>
<td>Rolling GR S (NLGI 2) is a summer grease.</td>
</tr>
</tbody>
</table>

**ROLLING GR grease has better anti-friction properties compared to the other calcium greases.**

**ROLLING GR grease unlike «IP-1» and «fatty Solidol» greases that are used is intended for application under high temperatures and mechanical loads, retains its properties for longer, thus extends bearing life and increase the time between equipment repairs and service.**

<table>
<thead>
<tr>
<th>TRIBOLOGICAL CHARACTERISTICS on 4-BALL MACHINE at (20±5) °C</th>
<th>ROLLING GR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø welding load, N, not less than</td>
<td>1980 / 3600*</td>
</tr>
<tr>
<td>Ø critical load, N, not less than</td>
<td>980 / 1150*</td>
</tr>
<tr>
<td>Ø scuff index, N, not less than</td>
<td>400 / 650*</td>
</tr>
<tr>
<td>Ø deterioration index (196N), mm, not more than</td>
<td>0,6 / 0,45*</td>
</tr>
</tbody>
</table>

* Average data for industrial batches.
COMPARATIVE CHARACTERISTIC
of tribological properties on 4-ball machine

ROLLING GR grease
Is tested and successfully applied:

Passed the tests

in Testing Center of products “UCAH-SEPRO” of NAU
at Ukrainian R&D center of hemmotology and certifications
of fuels, lubricants and technical liquids.

Tests report №953-954-VP/2010
dd 28th of January 2011.

While replacement by «ROLLING GR» grease a mixing with «Agrinol IP-1»
grease is possible. When mixing the characteristics of both greases are
averaged, but mixing possibility allows to change the grease without units
cleaning.

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COMPARATIVE CHARACTERISTIC of greases’ tribological properties on 4-ball machine

ROLLING GR grease
Tested and successfully applied on enterprises of DTEK group of companies

Agreed and recommended for road headers of JSC Yasinovatskiy Machine Building Plant

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**INDUSTRIAL TESTS:**

Is tested and recommended for application as an alternative for the rapeseed oil on Continuous Casting Machines:

- JSC «Yenakiieve Iron and Steel Works»
- TCA Steel Group

**ADVANTAGES**

- Extension of molds operating life (reducing the cost and effort for technical services and related downtime)
- Low smokiness
- High adhesion to the crystallizer walls
- Low coking ability
- Improves the castings quality

(in conditions of hot-metal contact forms carbonaceous layer that promotes ingot stretching and reduces the forming of surface effects due to uniform cooling)

While casting a continuous 120x120mm square billet the oil consumption is 150-160g/MT.

**Featured:**

- Lower smokiness in the area of jet dropping to the crystallizer comparing to the rapeseed oil.
- No pollution of the crystallizers' grease nipples with the combustion products.
INDUSTRIAL TESTS:
Is tested as an alternative to Azmol Termoform oil:

- **DMPZ Elektrostal**
- at non-locking casting on profiled CCM of **Meltshop Donetsk Electrometallurgical Plant**

**CONCLUSION:**

- When using Form Divider oil in mold the smooth flame intensity and stable combustion without increasing of metal spray-off and adhesion to the sleeve walls in the meniscus area is provided.

- According to evaluation of strand caster the flame dinginess along the stream was lower than with «Azmol Thermoform» oil application.

- When checking the billets form the pilot stream and comparing them to other ones no defects were detected.

- Macro-structure differences were not found.

**COMPATIBILITY**

- Not aggressive to the non-ferrous metal details.
- Is compatible with all of the used sealing materials and paints.

Actual specific consumption of Form Divider oil by melting series was **0,202 l/MT**, that is **below the norm (0,22 l/MT)**
## COMPARING CHARACTERISTIC of RELEASE AGENTS for CONTINUOUS STEEL CASTING

<table>
<thead>
<tr>
<th>Properties</th>
<th>Form Divider</th>
<th>Shell Release HCU</th>
<th>Form Divider M</th>
<th>Shell Release HCP</th>
<th>Form Divider Ultra</th>
<th>Shell Release HCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic viscosity, mm²/s:</td>
<td>45-65</td>
<td>40</td>
<td>40-80</td>
<td>55</td>
<td>Not less than 30</td>
<td>36</td>
</tr>
<tr>
<td>- at 40°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid number, mg KOH/g, not more than</td>
<td>0,5</td>
<td>0,1</td>
<td>1,5</td>
<td>0,3</td>
<td>0,3</td>
<td>0,5</td>
</tr>
<tr>
<td>Temperature, °C:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- flash point, not lower than</td>
<td>230</td>
<td>250</td>
<td>230</td>
<td>240</td>
<td>280</td>
<td>270</td>
</tr>
<tr>
<td>- pour point, not higher than</td>
<td>-12</td>
<td>-18</td>
<td>-12</td>
<td>-6</td>
<td>-25</td>
<td>-9</td>
</tr>
<tr>
<td>Saponification number, mg KOH/g, not more than</td>
<td>50-65</td>
<td>50</td>
<td>45-70</td>
<td>90</td>
<td>Not less than 180</td>
<td>180</td>
</tr>
<tr>
<td>Density, kg/m³, not more than</td>
<td>900 (at 20°C)</td>
<td>930 (at 15°C)</td>
<td>930 (at 20°C)</td>
<td>900 (at 15°C)</td>
<td>930 (at 20°C)</td>
<td>920 (at 15°C)</td>
</tr>
</tbody>
</table>
**AGRINOL** LUBRICATING MATERIALS OVERVIEW

**Agrinol I-HG-B** HYDRAULIC OILS

**HYDRAULIC OILS**

Agrinol I-HG-B 32; 46; 68; 100; 150; 220

Oils are used as a working liquid in hydraulic systems of machining equipment, automatic lines, presses, building, agricultural and road machinery, and also for lubrication of lightly and medium duty gears that guide sliding and rolling machines *where the oils with higher anti-oxidation properties are needed.*

HLP according to DIN 51524.2; HM according to ISO 6743-4.

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**PERFORMANCE TESTS**

-SE “DonGiproUgleMash” «Donetsk State Research, Planning-Design and Experimental Institute of Mine Integrated Mechanization»

- SPC “Mining machines”

**Chart 1. The frequency of oil changing at operation in regular conditions.**

**Oil type is IGP**

**Oils type are I-40, I-50**

**Agrinol I-HG-B**

«Agrinol I-HG-B» oil comparing to IGP type oils and I-40A, I-50A general purpose oils has **better performance properties and extended operating life** in regular conditions.

«Agrinol I-HG-B» oil is **ADDED** to the Manual for mining machines and **RECOMMENDED** for applying.

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http://www.agrinol.ua
AGRINOL I-HG-B oil is tested and successfully applied on:

PJSC “AZOVSTAL IRON & STEEL WORKS”
DTEK Pavlogradugol
JSC «NKMZ»
and others.
HYDRAULIC OILS

Hydroil HM
10; 22; 32; 46; 68; 80; 100; 120; 150; 200; 270; 330

«Cl Free» Hydraulic oils with excellent anti-oxidation and anti-wear properties operate in conditions of high pressure and extreme loads.

- HLP according to DIN 51524.2
- HM according to ISO 6743-4

Hydroil HM Ultra
22; 32; 46; 68; 100

Zn-Free hydraulic oils «Cl Free & Zinc Free» with excellent anti-oxidation and anti-wear properties are used in hydraulic drives that contain non-ferrous metals and alloys in construction elements, and operating vapors are characterized by extremely small gaps between units.

- HLP according to DIN 51524.2
- HM according to ISO 6743-4

Application of circulating oils of PREMIUM Zn Free group наиболее оправданно in units that operate under conditions of high and extreme temperatures, cyclic loading, day and night modes of operation: (hydraulic crystallizer sliding mechanisms, hydraulic drives clutches, hydraulic drives of leveller straightening machines, shears, stoppers and other)

!!! Absence of heavy metals and zinc compounds is safe for environment, human health and facilitates product recycling.!!!

LABORATORY TESTS: HYDROIL HM ULTRA Oil passes laboratory tests in BFB Oil Research S.A. (Belgium) according to DIN 51524.2.
**“AGRINOL” LUBRICATING MATERIALS OVERVIEW**

**GEAR OILS**

<table>
<thead>
<tr>
<th><strong>Highrate XP</strong></th>
<th>Gear oils for lubrication of all kind toothed, conical, helical and worm gears, closed gears with circulated greasing systems. For spray-off lubrication of different industrial equipment: metal-cutting and woodworking machines, presses, forging, founding and molding machines, rolling mills, mixers, dryers, extruders, fans, crushers, pumps, conveyors, elevators, lifts, rotary cement kilns, calendars paper machines, combines coal cutter-loaders, textile and spinning machines and other equipment. [CLP according to DIN 51517.3;]</th>
</tr>
</thead>
<tbody>
<tr>
<td>68; 100; 150; 220; 320; 460; 680</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Special Oil ART</strong></th>
<th>Gear oils for lubrication of all kind toothed, worm and helical gears of different industrial equipment that operates under normal and high temperatures. Especially suits for gears with a wide capacity range: from small motor-gears with the less than 1 kilowatt capacity to the big powerful motors that are used on rolling and cement plants and in lift mechanisms of mines. [CLP according to DIN 51517.3;]</th>
</tr>
</thead>
<tbody>
<tr>
<td>68; 100; 150; 220; 320; 460; 680</td>
<td></td>
</tr>
</tbody>
</table>

Lubricating materials of **Highrate XP** series contain advanced carefully balanced combination of additives to provide excellent protection from scuffing and micropitting.

**Ash-free additive package** in **Special Oil ART** provides exceptional anti-wear properties and allows oil usage in the friction units from non-ferrous metals and alloys.
THANK YOU for YOUR ATTENTION!

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