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Nekateri vidiki in izzivi mazanja livarskega bata z oljem

Some Aspects and Challenges of Lubricating the Foundry Piston with Oil

Povzetek

Mazanje bata na visokotlačnih livarskih strojih je vedno predstavljalo svojevrsten izziv. Za zagotavljanje zadostnega mazanja in doseganje dovolj visokega števila ciklov pred zamenjavo livarskega bata in livne komore je treba dodati zadostno količino maziva. Del maziva v fazi polnjenja komore odgori, del maziva pa prehaja v talino in jo tako kontaminira s produkti zgorevanja. Pri gorenju maziva nastajajo plini in nekateri trdi ostanki zgorevanja, kar povečuje plinsko poroznost odlitkov in nekovinske črne vključke.

Del maziva, ki med polnjenjem livne komore s talino zgori, povzroča neželen plamen ter emisijo strupenega in rakotvornega dima v okolici livarskega stroja.

Nekatera sintetična olja nudijo bistveno boljše mazanje, zato se potreba po vnosu maziva bistveno manjša.

Z boljšimi mazalnimi lastnostmi se poveča število ciklov, ki jih lahko izvedemo z enim batom, podaljša se tudi življenjska doba livne komore. Z daljšanjem uporabne dobe bata in livne komore ter s skrajšanjem zastojev zaradi zamenjav bata se znižajo stroški proizvodnje, hkrati pa se poveča razpoložljivost stroja.

Nekatere vrste sintetičnih maziv so formulirane tako, da pri visokih temperaturah razpadejo na nestrupene komponente, ki odparijo brez ostankov. Glavni poudarek prispevka bo zato na uporabi sintetičnih olj brez grafita. Z določenimi sintetičnimi olji opazno znižamo poroznost odlitkov, odpravimo del vključkov, ki so ostanki zgorevanja maziva in bistveno zmanjšamo plamen. Z odpravo dima, ki nastaja pri zgorevanju klasičnih maziv, preprečimo emisijo strupenih in rakotvornih plinov ter tako naredimo okolico stroja varnejšo in čistejšo.

Ključne besede: tlačno litje, livarski stroj, mazanje bata, sintetično olje

Summary

Lubricating the piston on high-pressure casting machines has always been a unique challenge. A sufficient amount of lubricant has to be added to ensure sufficient lubrication and to achieve an acceptably high number of cycles of the foundry piston and shot chamber. Part of the lubricant burns out during the filling phase of the sleeve, and part of the lubricant passes into the melt and thus contaminates it with the combustion products. When lubricant burns, gases and some solid combustion residues occur which increases the gas porosity of the castings and non-metallic black inclusions.

The part of the lubricant that burns during the filling of the shot sleeve with the melt causes an unwanted flame and the emission of toxic and carcinogenic smoke around a casting machine.

Some synthetic oils offer significantly better lubrication, as the amount of oil needed is significantly reduced.

With better lubricating properties, the number of cycles that can be performed with one piston is increased, and the lifetime of the shot chamber is also extended. By extending

the lifetime of the piston and shot chamber and shortening the downtime due to piston replacements, production costs are also reduced.

Some types of synthetic lubricants are formulated to decompose at high temperatures into non-toxic components that evaporate without residue. The main focus of the article will therefore be on the use of synthetic oils without graphite. With certain synthetic oils, we noticeably reduce the porosity of the castings, eliminate some of the inclusions as residues of lubricant combustion, and significantly reduce the flame. By eliminating the smoke generated by the combustion of classical lubricants, we prevent the emission of toxic and carcinogenic gases thus making the surroundings of the machine safer and cleaner.

Key words: high pressure die casting, casting machine, piston lubrication, synthetic oil

1 Sredstva za mazanje batov

Za mazanje batov obstajajo različna sredstva:

1. Trdna maziva
- Praški
- Peleti oziroma granulati
- Masti

Praški so prah naravnih ali sintetičnih voskov z dodanimi aditivi. Njihova barva je od bele do črne (vsebnost grafita). V raztaljenem stanju imajo visoko viskoznost, kar omogoča dobro mazanje bata in livne komore. Vedno se uporabljajo za mazanje v livno komoro.

Prednosti praškov:
- Zelo dobro mazanje in zaščita bata pred obrabo.
- Lahko izboljšajo tečenje taline v kanalih in orodju, kar izboljša kakovost ulitkov.

Omejitve praškov so:
- Povzročajo zelo velik plamen (nevarnost požara)
- Obilno dimljenje pri uporabi.
- Prah slabo teče, rad se zleplja in maši transportne kanale na napravi za doziranje.
- Praški povzročajo nečistost ulitkov in obloge na orodju.

Peleti ali granulati so enake sestave kot praški. Od praškov se razlikujejo samo

1 Piston lubrication agents

There are different agents to lubricate the piston:

1. Solid lubricants
- Powder
- Pellets or granules
- Greases

Powders are powdered natural or synthetic waxes with added additives. Their colour is white to black (graphite content). They have a high viscosity in a molten state, allowing good lubrication of the piston and the shot chamber. They are always used for lubrication in the shot chamber.

Benefits of powders:
- Very good lubrication and protection of the piston from wear.
- Can improve the melt flow in the channels and tools, which improves the quality of castings.

The limitations of powders are:
- Cause very high flame (fire hazard)
- Significant smoking when used.
- The powder flowing poorly, often bonding and blocking transport channels on the dosing device.
- Powders cause impurity to castings and linings on the tool.

Pellets or granules are made up of the same composition as powders. They

v fizični obliki. Njihove prednosti in slabosti so enake kot pri praških. Razlika (prednost) je, da se ne zlepljajo kot praški.

2. Maziva, ki jih mešamo z vodo
- Emulzije mineralnih in delno sintetičnih olj
- Emulzije sintetičnih olj

Emulzije mineralnih ali delno sintetičnih olj so mlečne emulzije olj visoke viskoznosti z dodanimi aditivi. Podobno je pri emulzijah sintetičnih olj, le da so olja popolnoma sintetična.

Prednost te skupine so:
- dobre hladilne lastnosti,
- pogosto (ne vedno) združljivost z ločilnimi sredstvi,
- pogosto nižja cena kot pri drugih vrstah maziv za bate.

Omejitve in pomanjkljivosti te skupine pa so:
- sredstva niso primerna za zahtevne primere uporabe,
- primerna so samo za manjše premere batov, maksimalno do 80 mm, kar pa je odvisno tudi od kvalitete maziva in količine nanosa,
- treba jih je uporabljati previdno. V primeru, da raztaljen aluminij pride v stik z vodo, lahko pride do izmeta taline v okolico stroja. Zato jih moramo nanašati zunaj livne komore. To je tudi razlog, da niso širše prisotna na tržišču.

3. Olja za mazanje batov:
- Olja na mineralni ali delno sintetični osnovi
- Olja na rastlinski osnovi
- Sintetična olja

Mineralna in delno sintetična olja imajo visoko viskoznost in so značilno rjavkaste barve. Dodani so jim aditivi za izboljšanje oprijemljivosti, za povišanje indeksa viskoznosti in izboljšanje nekaterih drugih

differ from powders only in physical form. Their advantages and disadvantages are the same as in powders. The difference (advantage) is that they do not bond like powders.

2. Lubricants mixed with water
- Emulsions of mineral and partly synthetic oils
- Emulsions of synthetic oils

Emulsions of mineral or semi synthetic oils are milk emulsions of high viscosity oils with added additives. This is similar to emulsions of synthetic oils, except that the oils are completely synthetic.

The advantages of this group are:
- Good cooling properties.
- Frequent (not always) compatibility with release agents.
- Often lower price than other types of piston lubricants.

However, the limitations and disadvantages of this group are:
- Not suitable for demanding applications.
- Only suitable for smaller piston diameters up to a maximum of 80 mm, depending also on the quality of the lubricant and the amount of application.
- Should be used with caution. When molten aluminium comes into contact with water, it may eject the melt into the surroundings of the machine. Therefore, they must be applied outside the shot chamber. This is also why they are not widely present on the market.

3. Piston lubrication oils:
- Mineral-based or semi-synthetic-based oils
- Vegetable-based oil
- Synthetic oils

Mineral-based or semi-synthetic-based oils have a high viscosity and are characterised by brownish colours. Additives

lastnosti. Na razpolago so v različnih viskoznostih od 300 mm^2/s do 1.000 mm^2/s z namenom zmanjšanja kapljanja in lažjega nanosa. V različnih obdobjih leta moramo uporabiti različne viskoznosti olja. (višja viskoznost poleti, nižja viskoznost pozimi).

Prednosti mineralnih in delno sintetičnih olj so:
- Dobro mazanjem in sposobnost zaščite bata pred obrabo
- Obilo izkušenj zaradi razširjenosti in dolgoletne prisotnosti na tržišču.
- Možnost izboljšanja osnovnih lastnosti z dodajanje trdnih maziv, na primer grafita.
- Lahko jih uporabimo za mazanje v ali zunaj livne komore.

Omejitve in pomanjkljivosti te skupine so:
- Nezdružljivost z ločilnimi sredstvi
- Povzročajo velik plamen, še zlasti, če jih uporabimo za mazanje v livno komoro.
- Pri zgorevanju nastajajo strupeni in kancerogeni plini.
- Manj »čista« kot sredstva, ki jih mešamo z vodo in kot sintetična olja, zato je v primeru njihove uporabe okolica stroja zelo zamaščena.

Rastlinska olja so rumenkasta in se uporabljajo aditivirana ali pa brez aditivov. Imajo visok indeks viskoznosti in dobre mazalne lastnosti. Pri termični razgradnji tvorijo značilen vonj po cvrtju in škodljive snovi (acrolein), ki so kancerogene.

Sintetična olja so bistre tekočine na osnovi sintetičnih tekočin in aditivov, ki izboljšajo oprijem, preprečujejo obrabo in izboljšujejo druge lastnosti. Imajo višji indeks viskoznosti kot mineralna olja, zato jih običajno ni treba menjati v različnih obdobjih leta.

Njihove prednosti so:
- Zelo dobro mazanje in zaščita bata pred obrabo.

have been added to improve adhesion, to increase the viscosity index and to improve certain other properties. They are available in different viscosities from 300 mm^2/s to 1,000 mm^2/s in order to reduce dripping and simplify the application. During different periods of the year, different viscosity oils must be used (higher viscosity in summer, lower viscosity in winter).

The advantages of mineral-based and semi-synthetic-based oils are:
- Good lubrication and the ability to protect the piston from wear.
- Significant experience due to its prevalence and longstanding presence on the market.
- The possibility of improving the basic properties by adding solid lubricants, such as graphite.
- Can be used for lubrication inside or outside the shot chamber.

The limitations and disadvantages of this group are:
- Incompatibility with release agents.
- Cause a large flame, especially when used for lubrication in the shot chamber.
- Toxic and carcinogenic gases are generated during combustion.
- Less “pure” than those mixed with water and synthetic-based oils, so when used, the surroundings of the machine are very greasy.

Vegetable-based oils are yellowish and are used with or without additives. They have a high viscosity index and good lubricating properties. In thermal decomposition, they form a characteristic smell of frying and harmful substances (acrolein) that are carcinogenic.

Synthetic-based oils are clear liquids based on synthetic liquids and additives that improve traction, prevent wear and improve other properties. They have a higher viscosity index than mineral-based oils, so

- Izredno visok indeks viskoznosti (slika 1)
- Nekatere vrste zagotavljajo visoko zmogljivost in so primerne za doziranje v zelo majhnih količinah.
- Lahko jih dodatno izboljšamo z dodatkom posebnih aditivov, ki jih običajno ne moremo dodajati v mineralna olja.
- Lahko jih uporabimo za mazanje zunaj ali v livno komoro (kapljično ali s pršenjem).
- Ne povzročajo dima.
- Povzročajo manj poroznosti.
- Ne povzročajo črnih nekovinskih vključkov.
- So biološko razgradljiva.

Omejitve sintetičnih olj so:

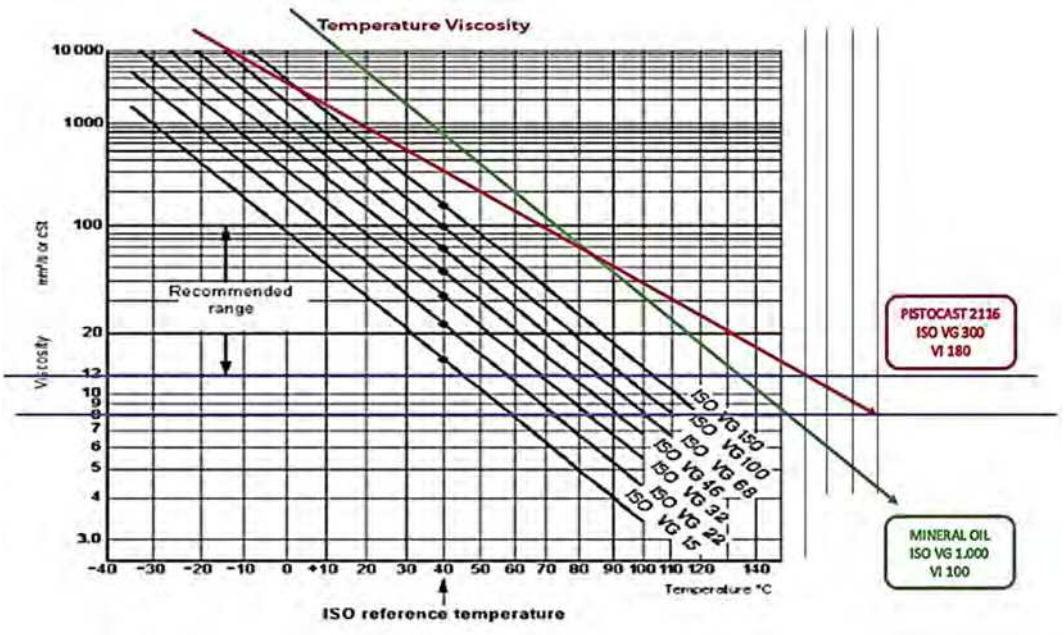
- Nezdružljivost z ločilnimi sredstvi.
- V primeru mazanja v livno komoro povzročajo plamen, ki pa je veliko

they usually do not need to be changed at different times of the year.

Their benefits are:

- Very good lubrication and protection of the piston from wear.
- Ultra-high viscosity index (Figure 1).
- Some types provide high performance and are suitable for dosing in very small amounts.
- Can be further improved by adding special additives that usually cannot be added to mineral-based oils.
- They can be used for lubrication outside or in the shot chamber (drip or spray).
- Do not cause smoke.
- Cause less porosity.
- Do not cause black non-metallic inclusions.
- Are biodegradable.

The limitations of synthetic-based oils are:



Slika 1. Vpliv indeksa viskoznosti olja na viskoznost pri visoki temperaturi

Figure 1. Effect of the oil viscosity index on the viscosity at high temperature

manjši kot pri mineralnih ali delno sintetičnih oljih ter trdnih mazivih.
- Nabavna cena na kg/L je višja od drugih maziv vendar je strošek uporabe nižji.

Sintetična olja zaradi svojih prednosti v zadnjem obdobju pospešeno nadomeščajo mineralna olja in trdna maziva.

2 Doziranje olj za mazanje batov

Sredstva za mazanje batov lahko doziramo v livno komoro ali na bat zunaj livne komore. Zaradi velikega odgora pri mazanju v komoro je v tem primeru potrebno dozirati bistveno večjo količino maziva (dvakrat do trikrat več) kot pri mazanju na bat zunaj komore. Zaradi prednosti olj pred trdnimi mazivi (predvsem možnost mazanja batov zunaj livne komore) se za mazanje batov vedno bolj pogosto uporabljajo olja. V nadaljevanju se bomo zato osredotočili na doziranje olj.

V uporabi sta dva sistema za doziranje olja. Starejši sistem deluje na principu nastavitve časa doziranja, novejši pa na principu nastavitve volumna olja. Prednost naprav, ki delujejo po prvem principu je nižja cena, prednost naprav z volumetričnim doziranjem pa je natančna količina doziranja neodvisno od temperature okolice in viskoznosti olja. Zaradi natančnega in ponovljivega volumna (pri vsakem udarcu) naprave z volumetričnim doziranjem, je poraba olja bistveno manjša, kot pri doziranju z napravo s časovno nastavitvijo. Primer naprave z volumetričnim doziranjem je prikazan na sliki 2.

3 Primeri iz prakse

Primer 1: Uporaba na stroju z večjim premerom bata (130 mm)

Zamenjava načina mazanja bata: granulat → sintetično olje brez grafita

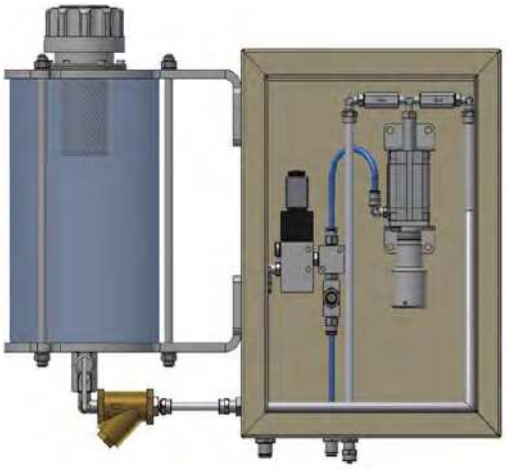
- Incompatibility with release agents.
- They cause a flame in case of lubrication in the shot chamber, but the flame is much smaller than that of mineral-based or semi-synthetic-based oils and solid lubricants.
- The purchase price per kg/l is higher than other lubricants but the cost of use is lower.

Recently, due to their advantages, synthetic-based oils have been rapidly replacing mineral-based oils and solid lubricants.

2 Dosing of piston lubrication oils

Piston lubrication agents can be dosed in the shot chamber or on the piston outside the shot chamber. Due to the large burn-out in lubricating in the chamber, a significantly higher quantity of lubricant (two to three times more) must be dosed than when lubricated on a piston outside the chamber. Due to the advantages of oils compared to solid lubricants (especially the possibility of lubricating pistons outside the shot chamber), the oils are increasingly used to lubricate the pistons. Below, we will therefore focus on oil dosing.

There are two oil dosing systems in use. The older system works on the principle of setting the dosing time, and the newer one on the principle of adjusting the oil volume. The advantage of devices operating based on the first principle is lower price, and the advantage of devices with volumetric dosing is the precise amount of dosing independent of ambient temperature and oil viscosity. Due to the precise and repeatable volume (at every impact) of the device with volumetric dosing, the oil consumption is significantly lower than when dosed with setting the time. An example of a device with volumetric dosing is shown in Figure 2.



Slika 2. Mazalna naprava z volumetričnim doziranjem

Figure 2. Lubricating device with volumetric dosing

Robni pogoji so navedeni v preglednici 1, mazanje pa prikazuje slika 3.

Ugotovljene prednosti pri zamenjavi granulata s sintetičnim oljem so bile:

- minimalen plamen,
- brez dima,

3 Practical Examples

Case 1: Use on a machine with a larger piston diameter (130 mm)

Replacing piston lubrication agent: granulate → synthetic oil without graphite.

Preglednica 1. Robni pogoji na stroju Bühler Carat 160

Table 1. The boundary conditions on Bühler Carat 160 machine

Stroj / Machine:	BUHLER Carat 160
Premer bata / Piston diameter:	130 mm
Delovni gib bata / Piston working stroke:	600 mm
Hitrost bata v 2' fazi / Piston speed in 2' phase	3,96 m/s
Temperature bata / Piston temperature	90 °C
Masa taline / Melt weight	8,4 kg
Zlitina / Alloy	DIN 223
Dnevno število ciklov / Daily number of cycles	1.100
Predhodno v uporabi / Previously in use	
Mazalno sredstvo za bat / Piston lubricant	granulat / granulate
Mesto doziranja / Dosing point	v livno komoro / in the shot chamber
Poraba granulata / Granulate consumption	4,1 g/udarec / g/stroke
V uporabi zdaj / Now in use	BARALDI PISTOCAST 2116
Mesto doziranja / Dosing point	v livno komoro / in the shot chamber
poraba sintetičnega olja / Synthetic-based oil consumption	1.2 g/udarec / g/stroke

Slika 3. Premer bata 130 mm: doziranje v livno komoro

Figure 3. Piston diameter 130 mm: dosing in shot chamber

- znižana poroznost odlitka,
- odlitek brez črnih vključkov,
- kakovostnejša površina odlitka,
- znižanje izmeta,
- podaljšana uporabna doba bata (iz 4.800 na 8.600 udarcev)
- znižanje stroškov proizvodnje (poraba bata, zastoj za zamenjavo bata, nižji izmet, višja produktivnost)
- izboljšanje kakovosti zraka v proizvodni hali (brez dima, brez strupenih plinov)

Neposredni prihranki stroškov maziva za mazanja bata pa so bili:

Strošek prej uporabljanega izdelka- strošek zdaj uporabljanega izdelka na 1000 kosov

16,40 € – 6,00 € = 10,40 €/1.000 kosov
11,28 €/dan/stroj = 3.720 €/leto/stroj (upoštevanih 330 delovnih dni).

The boundary conditions are given in Table 1 and the lubrication is shown in Figure 3.

The advantages identified in replacing the granulate with synthetic-based oil:

- Minimal flame.
- Smoke free.
- Reduced porosity of casting.
- Casting without black inclusions.
- Bigger quality of casting surface.
- Reduction of ejection.
- Extended piston life **(from 4,800 to 8,600 strokes).**
- Decrease in production costs (piston ware, piston replacement congestion, lower ejection, higher productivity).
- Improving air quality in production hall (no smoke, no toxic gases).

The direct cost savings of lubricants for piston lubrication were as follows:

The cost of the previously used product - the cost of the product now used per 1,000 pieces.

Primer 2: Uporaba na stroju z večjim premerom bata (105 mm)

Zamenjava mazanja bata: mineralno olje → sintetično olje brez grafita

Robni pogoji so navedeni v preglednici 2, mazanje pa prikazuje slika 4.

Ugotovljene prednosti pri zamenjavi mineralnega olja s sintetičnim oljem so bile:

- manjši plamen,
- brez dima,
- bistveno znižana poroznost odlitka,
- odlitek brez črnih vključkov,
- kakovostnejša površina odlitka,
- podaljšana uporabna doba bata (iz 10.600 na 14.800 udarcev),
- znižanje izmeta zaradi poroznosti in črnih vključkov,
- znižanje stroškov proizvodnje (poraba bata, zastoj za zamenjavo bata, nižji izmet, višja produktivnost),
- izboljšanje kakovosti zraka v proizvodni hali (brez dima, brez strupenih plinov),
- izboljšanje čistosti okolice stroja (brez politega olja zaradi tečenja olja z bata),
- ni potrebne menjave viskoznosti olja ali

€16.40 – €6.00 = €10.40/1,000 pcs
€11.28/day/machine= €3,720/year/machine
(330 working days taken into account)

Case 2: Use on a machine with a larger piston diameter (105 mm)

Replacing piston lubrication: mineral oil → synthetic oil without graphite.

The boundary conditions are given in Table 2 and the lubrication is shown in Figure 4.

The advantages identified in replacing the mineral-based oil with synthetic-based oil:

- Smaller flame.
- Smoke free.
- Significantly reduced porosity of casting.
- Casting without black inclusions.
- Bigger quality of casting surface.
- Extended piston life (from 10,600 to 14,800 strokes).
- Reduction of ejection due to porosity and black inclusions.

Preglednica 2. Robni pogoji na stroju Bühler Carat 160

Table 2. The boundary conditions on Bühler Carat 160 machine

Stroj / Machine:	BUHLER Carat 160
Premer bata / Piston diameter:	105 mm
Delovni gib bata / Piston working stroke:	600 mm
Hitrost bata v 2' fazi / Piston speed in 2' phase	4,20 m/s
Temperature bata / Piston temperature	100 °C
Masa taline / Melt weight	5,1 kg
Zlitina / Alloy	DIN 223
Dnevno število ciklov / Daily number of cycles	1.200
Predhodno v uporabi / Previously in use	
Mazalno sredstvo za bat / Piston lubricant	Mineralno olje (1.000 cSt)
Mesto doziranja / Dosing point	v livno komoro / in the shot chamber
Poraba mineralnega olja / Mineral-based oil consumption	3,0 g/udarec / g/stroke
V uporabi zdaj / Now in use	BARALDI PISTOCAST 2116
Mesto doziranja / Dosing point	v livno komoro / in the shot chamber
Poraba sintetičnega olja / Synthetic-based oil consumption	1.0 g/udarec / g/stroke

Slika 4. Premer bata 105 mm: doziranje na bat

Figure 4. Piston diameter 105 mm: dosing on piston

količine doziranja v odvisnosti od letnega časa in temperature okolice.

Neposredni prihranki stroškov maziva za mazanja bata so bili:

Strošek prej uporabljanega izdelka- strošek zdaj uporabljanega izdelka na 1000 kosov:

9,38 € – 5,70 € = 3,68 €/1.000 kosov
11,26 €/dan = 3.715 €/leto/stroj
(upoštevanih 330 delovnih dni).

Primer 3: Uporaba na stroju z manjšim premerom bata (60 mm)

Zamenjava mazanja bata: granulat → sintetično olje brez grafita

Robni pogoji so navedeni v preglednici 3, mazanje pa prikazuje slika 5.

Ugotovljene prednosti pri zamenjavi granulata s sintetičnim oljem so bile:

- minimalen plamen,
- Decrease in production costs (piston ware, piston replacement congestion, lower ejection, higher productivity).
- Improving air quality in production hall (no smoke, no toxic gases).
- Improving the cleanliness of the machine's surroundings (without oil spilled off the piston).
- No need to change the viscosity of the oil or the amount of dosing depending on the season and ambient temperature.

The direct cost savings of lubricants for piston lubrication were as follows:

The cost of the previously used product - the cost of the product now used per 1,000 pieces.

€9.38 – €5.70 = €3.68/1,000 pcs
€11.26/day = €3,720/year/machine
(330 working days taken into account)

- brez dima,
- bistveno znižana poroznost odlitka,
- odlitek brez črnih vključkov,
- kakovostnejša površina odlitka
- podaljšana uporabna doba bata (iz 12.000 na 22.000 udarcev)

Case 3: Use on a machine with a smaller piston diameter (60 mm)

Replacing piston lubrication: granulate → synthetic oil without graphite.

The boundary conditions are given in Table 3 and the lubrication is shown in Figure 5.

Preglednica 3. Robni pogoji na stroju Colosio

Table 3. The boundary conditions on Colosio machine

Stroj / Machine	COLOSIO
Premer bata / Piston diameter	60 mm
Delovni gib bata / Piston working stroke	280 mm
Hitrost bata v 2' fazi / Piston speed in 2' phase	2,92 m/s
Temperature bata / Piston temperature	80 °C
Masa taline / Melt weight	2,1 kg
Zlitina / Alloy	DIN 226
Dnevno število ciklov / Daily number of cycles	2.200
Predhodno v uporabi / Previously in use	
Mazalno sredstvo za bat / Piston lubricant	granulat / granulate
Mesto doziranja / Dosing point	v livno komoro / in the shot chamber
Poraba granulata / Granulate consumption	1,6 g/udarec / g/stroke
V uporabi zdaj / Now in use	BARALDI PISTOCAST 2116
Mesto doziranja / Dosing point	V livno komoro / In the shot chamber
poraba sintetičnega olja / Synthetic-based oil consumption	0.48 g/ udarec / g/stroke

Slika 5. Premer bata 60 mm: doziranje v livno komoro

Figure 5. Piston diameter 60 mm: dosing in shot chamber

- izboljšanje kakovosti zraka v proizvodni hali (brez dima, brez strupenih plinov)
- znižanje izmeta zaradi poroznosti na 0,01 %
- znižanje stroškov proizvodnje (poraba bata, zastoj za zamenjavo bata, nižji izmet, višja produktivnost)

Neposredni prihranki stroškov maziva za mazanja bata so bili:

Strošek prej uporabljanega izdelka-strošek zdaj uporabljanega izdelka na 1000 kosov
6,56 € – 2,88 € = 3,68 €/1.000 kosov
8,10 €/dan = 2.670 €/leto/stroj
(upoštevanih 330 delovnih dni)

4 Zaključek

Mazanje batov je pomemben vidik pri proizvodnji ulitkov, saj vpliva na stroške proizvodnje, kakovost ulitkov in okolje.

V prispevku so bila našteta različna maziva za mazanje bata in omenjene njihove prednosti in slabosti. Zaradi svojih prednosti se vse bolj uveljavljajo sintetična olja, še zlasti tista, ki ne vsebujejo grafita. Zato so v zadnjem delu prispevka navedeni trije primeri uporabe sintetičnih olj brez grafita in prihranki, vezani na mazivo, ki so bili doseženi z zamenjavo granulata ali mineralnega olja s sintetičnim oljem brez grafita.

Viri / Sources

1 MotulTech Baraldi, Interno gradivo / internal material
2 Olma d.o.o., Rezultati testiranj v različnih livarnah v Sloveniji in tujini / Results of tests in various foundries in Slovenia and abroad

The advantages identified in replacing the granulate with synthetic-based oil:

- Minimal flame.
- Smoke free.
- Significantly reduced porosity of casting.
- Casting without black inclusions.
- Bigger quality of casting surface.
- Extended piston life **(from 12,000 to 22,000 strokes).**
- Improving air quality in production hall (no smoke, no toxic gases).
- Reduction of ejection due to porosity to 0.01 %.
- Decrease in production costs (piston ware, piston replacement congestion, lower ejection, higher productivity).

The direct cost savings of lubricants for piston lubrication were as follows:

The cost of the previously used product - the cost of the product now used per 1,000 pieces.
€6.56 – €2.88 = €3.68/1,000 pcs
€8.10/day = €2,670/year/machine
(330 working days taken into account)

4 Conclusion

The lubrication of pistons is an important aspect in the production of castings, since it affects the cost of production, the quality of castings and the environment.

The article listed the various lubricant for lubricating the piston as well as their advantages and disadvantages. Synthetic-based oils are increasingly being used due to their advantages, especially the oils not containing graphite. Therefore, the final part of the article lists three examples of how the use of graphite-free synthetic-based oils and lubricant related savings were achieved by replacing granulate or mineral-based oil with synthetic-based oil without graphite.