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UTJECAJ EUROPSKIH ZAHTJEVA ZA KVALITETOM MAZIVA I SMJERNICE RAZVOJA DJELATNOSTI MAZIVA U HRVATSKOJ

Sažetak

U Republici Hrvatskoj prisutan je relativno povoljan trend obnove voznog parka osobnih vozila, lakih gospodarskih vozila (LGV) i motocikla, međutim, teška gospodarska vozila (preko 3,5 t) i industrijski park se sporije obnavljaju. Ta činjenica ima određeni utjecaj na brzinu prihvaćanja trenda promjene i uvađanja novih razina kvalitete maziva.

Ovaj rad daje kratki pregled ključnih zahtjeva za kvalitetom maziva i srodnih proizvoda posebice onih koje diktiraju europski konstruktori i proizvođači vozila (OEM), opreme za vozila i industrijske opreme i njihov mogući utjecaj na tržište maziva u Hrvatskoj. Također je dana procjena promjene asortimana maziva po tipovima u zadnje tri godine kao primjer utjecaja novih specifikacija maziva. Razmatran je i utjecaj trendova u području kvalitete i primjene različitih klasa baznih ulja i očekivani trend primjene u modernim formulacijama maziva. Na kraju je razmatran utjecaj i specifičnosti okruženja u djelatnosti maziva u Hrvatskoj s naglaskom na svjetske trendove.

Predočene smjernice mogućeg razvoja tržišta i djelatnosti maziva u Hrvatskoj su prvenstveno zaključci autora temeljem procijenjene brzine promjene i mogućnosti tržišta da prihvati europske trendove.

KAPACITET I INTEZITET OBNOVE VOZNOG PARKA U HRVATSKOJ

S namjerom da se dobije uvid u trenutačnu zastupljenost proizvođača vozila u Republici Hrvatskoj obavljena je analiza udjela temeljem situacije tijekom 2000. godine[1]. Tako se iz slike 1 vidi da su kod osobnih vozila još uvijek najprisutnija vozila Zastava. Međutim, ako se ukupno gledaju vozila iz grupe VW/Seat/Škoda/Audi onda je taj mega-proizvođač na prvom mjestu. Prisutnost Opel-a i općenito GM-a, kao i udruženih francuskih proizvođača je također vrlo visoka. Starost vozila je drugi važan faktor i nije predmet ovog rada zbog različitih razloga, ali dovoljno je reći da u pogledu starosti osobnih vozila prednjače vozila proizvođača Zastava. S druge strane postavlja se pitanje koliko ovih najstarijih vozila, a registriranih, jest uopće u prometu. Prisutnost oko 30-tak marki proizvođača je faktor koji može značiti samo više mogućnosti za obnovu voznog parka. Očekuje se da i dalje dominiraju vozila europskih konstruktora i proizvođača vozila uz možda nešto veći udio francuskih proizvođača nego što je to do sada bio slučaj.

Iz slike 2 uočava se da u području teških gospodarskih vozila (TGV), dakle komercijalnih vozila nosivosti iznad 3,5 t, prednjače prema očekivanjima vozila Mercedes-Benza tj. Daimler-Chryslera. Odmah do njih također prema očekivanjima su vozila MAN-a i TAM-a. Ovdje je prisutan veliki broj marki, a u budućnosti se očekuje da proizvođači kao što su Volvo, Iveco i Scania dobiju veći udio na tržištu u sklopu obnove navedenog voznog parka.

U području LGV ima preko 30-ak marki, prednjače VW i MB, a za njima nešto starije proizvodnje vozila TAM i Zastava. Intenzitet obnove ovdje je nešto brži i u budućnosti se može očekivati da će doći do daljnje promjene udjela na tržištu. Očekuje se da će biti veći udio francuskih proizvođača i tvrtke FIAT.

Iz slike 4 vidi se da kod autobusa dominira još uvijek tvrtka TAM i vrlo je teško prognozirati buduću zastupljenost tipova autobusa na tržištu Hrvatske. Najveći "boom" u otvaranju tržišta vozila i intenzitetu zamjene je u području mopeda i motocikla. Razlog tome nije samo prihvatljivost cijene vozila (na dva kotača) nego i određena sklonost mentaliteta vozača i klimatski uvjeti, posebno u Dalmaciji. Proizvođač vozila Tomos, sada u poziciji lidera na hrvatskom tržištu, u budućnosti će imati velikih problema zbog agresivnih nastupa i osvajanja tržišta prvenstveno od tvrtki kao što su Piaggio, Vespa, Gillera i Peugeot.

Sumirajući zastupljenost vozila vidi se da je prema ukupnom broju vozila (tablica 1) najveći broj vozila, prema očekivanju, u području osobnih vozila.

Nadalje vidi se da je koncentracija vozila najveća u široj regiji Zagreba te da se očekuje najveći intenzitet obnove (do 10%) kod mopeda i motocikla, osobnih vozila i možda autobusa.

Valja spomenuti na primjeru osobnih vozila da procijenjeni kapacitet obnove, oko 120.000-130.000 vozila, još nije dostignut. Naime, već nekoliko godina se spominje ova brojka bez obzira radi li se o novim automobilima ili rabljenim vozilima, a registracija novih vozila nikad nije prešla brojku od 60.000. Realizacija tog nazivnog ili procijenjenog kapaciteta obnove direktno ovisi o gospodarskoj situaciji, standardu potencijalnih vlasnika osobnih vozila i tek onda o konkurentnosti, ponudi i uvjetima prodaje vozila.

Tablica1: Vozni park u RH (zaključno sa 31.12.2000. godine)[1]

Tip vozila	Broj vozila	ZG županija	Prosjek obnove 1996/2000.	Procjena inteniteta obnove god.
	Komada	%	%	%
Osobna vozila	1.130.828	35	3,5 - 4,5	10
TGV (preko 3,5 t)	28.953	26	1,0 – 2,0	8
LGV (do 3,5 t)	84.211	30	2,5 - 5,5	5
Autobusi	4.658	23	do 1,5	10
Mopedi i motocikli	65. 025	16,5	4,5 – 8,5	10
Ukupno	1.313.675			

Tablica 2: Starost vozila u Republici Hrvatskoj (%)[1]

Tip vozila	Do 5 godina	5 do 10godina	10 godina ili više
	%	%	%
Osobna vozila	18,5	26,0	55,5
TGV	7,5	14,5	78,0
LGV	18,5	22,5	59,0
Autobusi	7,5	27,5	65,0
Mopedi i motocikli	35,0	20.0	45,0

Podatak koji je već dostupan široj javnosti da je prosječna starost voznog parka, tj. vozila oko 11.3 godine, zapravo u marketinškom smislu ne znači ništa, jer je važna pojedinačna analiza po tipovima i po markama vozila. Ono što se može vidjeti u tablici 2 ukazuje na grubu podjelu na tri grupe vozila po starosti, tj. na raspodjelu udjela vozila po starosti. Očito je da je oko 50% vozila starije od 10 godina u grupi osobnih vozila, mopeda i motocikla,

dakle vozila za osobne potrebe. S druge strane, kod vozila koja su u vlasništvu tvrtki, dakle služe uglavnom za komercijalne potrebe, ima od 60 do 80% vozila starijih od 10 godina. Dublje analize ovih podataka i dodatnih podataka sigurno mogu dati kvalitetne informacije prodavačima maziva u smislu prilagođavanja i definiranja marketinške strategije i prodajnog asortimana za tržište Hrvatske.

KLJUČNI ZAHTJEVI ZA MOTORNA ULJA U EUROPI

Na ponudu maziva na jednom tržištu, u ovom slučaju motornih ulja ili općenito ulja i tekućina za motore i motorna vozila, utječu u prvom redu specifikacije originalnih proizvođača vozila i opreme za vozila, starost, broj marki i raspodjela postojećeg voznog parka. Sukladno tome i trendovi koji se pojavljuju u razvijenoj Europi u pogledu zahtjeva za kvalitetom maziva imaju, manje ili više, direktan utjecaj na promjenu programa i ponude maziva na pojedinom regionalnom tržištu.

U tom smislu mogu se navesti neki od najnovijih zahtjeva za kvalitetom motornih ulja koji će sigurno imati utjecaj na tržište Hrvatske. Ovi ponajprije europski trendovi-smjernice za razvoj i unapređenje kvalitete i komercijalnih programa maziva će se sukladno promjeni voznog parka, tj. intenzitetu obnove vrlo brzo realizirati kod većine ozbiljnih prodavača maziva na tržištu Hrvatske.

Najnoviji zahtjevi za ulja za motore i motorna vozila su slijedeći:

- Smanjenje emisije ispušnih plinova

Razvoj konstrukcije motora ide u pravcu poboljšanih svojstava motora (benzinskih i dizelovih) s jedne strane i kvalitete motornih ulja s druge strane, temeljen na boljoj kvaliteti goriva s konačnim zajedničkim ciljem uštede, tj. boljom ekonomičnosti goriva tijekom vožnje i korištenja vozila.

- Produljenje intervala zamjene ulja za osobna vozila

Većina renomiranih proizvođača navodi i zahtijeva korištenje ulja s produženim intervalom zamjene ulja kod osobnih vozila od 15 pa do 30.000 km, što se vidi u tablici 4. U nekim slučajevima taj interval zamjene produžen je u prosjeku na 30.000 pa čak i do 50.000 prijeđenih kilometara. Međutim, još uvijek vrijedi preporuka da se ulje mora mijenjati barem jednom godišnje.

- Produljenje intervala zamjene ulja za teško opterećena komercijalna vozila

Većina renomiranih proizvođača teško opterećenih vozila navodi i zahtjeva korištenje ulja s produženim intervalom zamjene ulja koji kod nekih novih

vozila prelazi i 100.000 prijeđenih kilometara. Međutim, taj produženi interval zahtijeva se samo u slučajevima nekih novih tipova vozila uz određena ograničenja ili posebne zahtjeve (vidi tablicu 5), kao što su prvenstveno obavezno korištenje najkvalitetnijih niskosumpornih goriva i provođenje posebnih fleksibilnih servisa.

- Poboljšana radna svojstva kod nižih i kod povišenih radnih temperatura

Ovi novi zahtjevi rezultat su težnje konstruktora vozila za boljom zaštitom motora kao i zahtjevom da se osiguraju bolja zahtijevana radna svojstva vozila u vožnji.

- Bolja oksidacijsko-termička svojstva kao i bolja EP svojstva

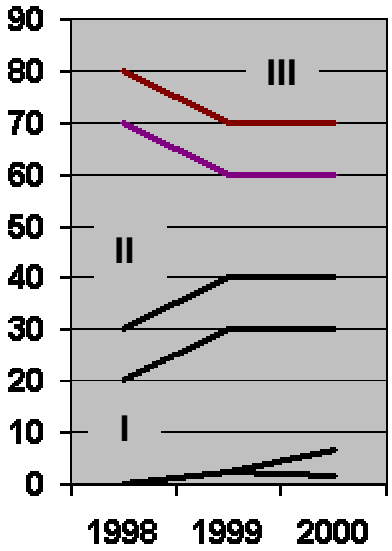
Savršenije konstrukcije motora, u prvom redu manji volumen motora, veća izlazna snaga, veće brzine vožnje, manja vozila, više dizelovih motora, manje mogućnost iscurenja maziva utječu na pojedinačne zahtjeve kao što je npr. manja količina uljnog punjenja. Općenito rezultat ovih utjecaja novih zahtjeva-novih konstrukcija jest veće opterećenje mazivog sloja i češća izloženost maziva većim temperaturnim šokovima.

Kao rezultat pojavilo se nekoliko novih specifikacija i zahtjeva za kvalitetom motornih ulja za osobna vozila koji su prikazani u tablici 3.

Tablica 3: Nove specifikacije motornih ulja za osobna vozila

VW 503.00	Ulja za benzinske motore, zahtjev za niskom viskoznošću, produženi vijek izmjene do 30.000 km
VW 503.01	Isto kao VW 503.00, samo posebni zahtjev za AUDI
VW 506.00	Ulja za osobna vozila s diezelovim motorom, produženi interval zamjene do 50.000 km, ali ne za motore s injektorskim sustavom
VW 506.01	Ulja za dizelove motore s poboljšanom zaštitom od trošenja i produženim intervalom zamjene ulja do 50.000 km Osnova A3/B4-98 plus posebni VW testovi
MB 229.5	Uje s više gradacija (SAE 0W-X, 5W-X, 10W-X), produženi interval zamjene ulja do 50.000 km Osnova ACEA A3,B3, B4 (1999) plus MB motorni testovi i posebni vlastiti testovi te praktična ispitivanja
BMW Longlife Oil	Osnova ACEA A3/B3 plus BMW M52 test, interval zamjene ulja 20.000 ± 5.000 km
BMW factory Oil od 3/2000	Osnova ACEA A3/B4
PORSCHE Service Fill	Osnova ACEA A3, dopuštene gradacije SAE 0W-40, 5W-40, 10W-40, 5W-50, 10W-50

Tablica 4: Procjena potrošnje motornih ulja za osobna vozila na tržištu Hrvatske (%), po razinama kvalitete



Klasa	Razina kvalitete	1998.	1999.	2000.
I vrhunsko ulje sintetika	*ACEA A3/B3/B4-98 VW 502.00/505.00 BMW Longlife*	0	oko 2.5	1.5-6.5
II srednja i viša kvaliteta polusintetika	*ACEA A3/B3-96 VW.500.00/505.00 API SJ/CF*	20-30	30-40	30-40 (cca 75)
III Fighting grade mineralna osnova	*API SG/CD ili niže CCMC G4/PD2*	70-80	60-70	60-70 (cca 25)

Tablica 5: Pregled produljenja intervala zamjene motornih ulja za teško opterećena komercijalna vozila europskih konstruktora i proizvođača

OEM	Najveći preporučeni interval zamjene ulja	Razina kvalitete / specifikacije	Napomena
MB	100.000 km	MB 228.5	Za ACTROS kamione
IVECO	100.000 km	E5	EURO III f uz TI tekući filter
MAN	80.000 km	M 3277	TGA, ima ugrađen EGR EURO III by-pass filter
DAF	100.000 km	E4	by-pass filter
RVI	60.000 km	RLD	
SCANIA	120.000 km	LDF	
VOLVO	100.000 km	VDS-3	EURO III

Međutim, ako pogledamo stanje u Hrvatskoj glede potrošnje motornih ulja po razinama kvalitete što se vidi u tablici 4, uočava se da je najveća potrošnja tipa 3 ili fighting-grade, dakle motornog ulja najniže razine kvalitete s najpovoljnijom komercijalnom ponudom. Ta potrošnja je malo pala u zadnje 2-3 godine u korist potrošnje više razine kvalitete, ali ona još uvijek predstavlja preko 60% ukupnog tržišta. Ipak, pozitivno je što je unatrag godinu i pol porasla potrošnja sintetičkog motornog ulja vrhunske kvalitete. Međutim, ova analiza metodom slučajnog uzorka pokazuje da većina prodavača motornih ulja (od 23 marke) ne proizvodi sve potrebne tipove nego najčešće nudi samo dvije kvalitete u nekoliko gradacija (brojke u zagradi, kolona 3 za 2000. godinu), te da naglasak daju na promidžbu i prodaju ulja srednje kvalitete, bez obzira na tehnički servis i stvarne potrebe kupca.

Tablica 6: Procjena potrošnje motornih ulja za komercijalna vozila na tržištu Hrvatske po razinama kvalitete za razdoblje 1998-2000 (%)

Klasa	Razina kvalitete	1998.	1999.	2000.
I vrhunsko ulje UHPD polusintetika	ACEA E4-98 SAE 10W-40, 5W-40, 5W-30 MB 228.5 MAN 3277 VOLVO VDS-2 MTU-Type 3	0	0	0.5 do 1.0
II visoka kvaliteta SHPD mineralna osnova	ACEA E3 isuue 2 SAE 15W-40 10W-40, 10W-30 MB 228.3 MAN M 3275 IVECO T-2 API CE/CF/SF	2.6	16.2	20-25 (5 –90)
III dobra kvaliteta mineralna osnova	ACEA E2 ACEA E1-issue 2 SAE 15W-40 VOLVO VDS IVECO T-1 API CF/CF-4/SG	30	25	do 20 (2-45)
IV fighting grade mineralna osnova	bez ACEA zahtjeva SAE 15W-40 ZF TE-ML 03A API CD ili ni e	65	50	45-50

Produljenje intervala zamjene motornih ulja za komercijalna vozila

Kao što je već rečeno i navedeno u tablici 5, produljenje intervala zamjene motornih ulja kod teško opterećenih vozila moguće je samo uz provođenje posebnih servisa vozila i korištenje najkvalitetnijih niskosumpornih goriva. Međutim, valja spomenuti da je podloga ili bolje rečeno uvjet da se to postigne u prvom redu korištenje boljih, vrhunskih formulacija motornih ulja. Takva "top-tier" ulja (kvaliteta UHPD vidi tablicu 6) formuliraju se na osnovi nekonvencionalnih baznih ulja visokog IV i/ili sintetičkih baznih ulja. Formulacije moraju osigurati bolju oksidacijsku i termičku stabilnost, a komercijalna strana cijele priče je u ekonomičnosti goriva. Na različitim tržištima će prije ili kasnije kao posljedica ovih trendova doći do povećanja cijene maziva i povećanja troškova ispitivanja maziva što će direktno utjecati na promjenu uvjeta poslovanja na tržištu maziva. Većina prodavača i proizvođača maziva će sukladno specifičnostima pojedinih tržišta morati provesti racionalizaciju komercijalnog programa motornih ulja za komercijalna ali i osobna vozila.

Global DHD-1 - Nova preporuka za razinu kvalitete teško opterećenih Diesel motora[2,3]

Nacrt nove specifikacije prezentiran je sredinom 2000. godine u Parizu na simpoziju CEC/SAE. Ova specifikacija je rezultat zajedničkog razvoja i dogovora renomiranih strukovnih udruženja: ACEA (European Manufacturers Association), EMA (Engine Manufacturers Association) i JAMA (Japan Automobile Manufacturers Association). Zajednički cilj navedenih organizacija je bio pokušaj stvaranja svjetski prihvaćene (globalne) specifikacije koja će u prvom redu zadovoljiti svjetski prihvaćene zahtjeve postavljene još 1998. godine za smanjenjem emisije ispušnih plinova. Cilj je bio, također, da se smanje troškovi ispitivanja i homologacija i poboljša razumijevanje potrošača. To je izjavio predstavnik ACEA Bengt Otterhom i dodao da je to također smjernica prema stvaranju samo nekoliko svjetskih specifikacija koje bi trebale zamijeniti veći broj lokalnih ili regionalnih specifikacija.[2]

U praksi ova nova specifikacija definira minimalne zahtjeve za radnim svojstvima motornog ulja za 4-taktne teško opterećene brzohodne dizelove motore. Namijenjena je prvenstveno japanskim konstruktorma i proizvođačima u slučajevima kad se ne može koristiti ili primijeniti originalno ulje ili kad se ne preporučuje japanska specifikacija JASO DH-1. Nedostatak ove nove

specifikacije je što ne sadrži sve zahtjeve koji su sadržani u poznatim API CH-4. JASO DH-1 ili ACEA E5 specifikacijama.

Ključni zahtjevi za ATF ulja

Trendovi razvoja ATF ulja u posljednjih desetak godina posljedica su ubrzanog razvoja novih konstrukcija automatskih mjenjača posebno od europskih konstruktora i proizvođača kao što su u prvom redu ZF i VOITH[4]. Kao rezultat toga razvoja danas se posebno ističu sljedeći novi zahtjevi za moderne ATF tekućine:

- produženi interval zamjene ulja (od 120.000 do 150.000 km),
- bolja oksidacijska stabilnost,
- bolja svojstva detergentnosti,
- bolja reološka svojstva ulja - posebno smična stabilnost, niža viskoznost, veći IV,
- sposobnost sprječavanja trešnje mjenjača – shudera,
- bolja sposobnost mijenjanja stupnjeva prijenosa mjenjača – shiftability,
- poboljšani hladni start – bolje ponašanje ulja kod pumpanja,
- u modernim formulacijama ATF tekućina preporučuje se uporaba PAO, a ne dopušta se korištenje esterskih i hidrokrekiranih baznih ulja.

Tablica 7: Procjena potrošnje ATF ulja u Hrvatskoj po razinama kvalitete za razdoblje 1998-2000, %

Klasa	Razina kvalitete	1998.	1999.	2000.
I vrhunsko ulje sintetika, polusintetika	DEXRON® III VOITH G 1363 ZF TE-ML 02F, 09A, 14 B i C MAN 339 Type F MB 236.1, 236.8, 236.81 i 236.9	0	0	do 1.5
II visoka kvaliteta mineralna osnova	DEXRON® IiD VOITH G 607 ZF TE-ML 03D, 04D, 09B, 11A i 14D MAN 339 Type D MB 236.6	19.3	20	20-30
III niža kvaliteta	GM Type A Suffix A	80.7	80	60-70

Iz tablice 7 vidi se da je tek tijekom 2000. godine došlo do prve makar minimalne potrošnje ATF tekućine najviše razine kvalitete. Međutim, još uvijek najveći udio potrošnje pripada ATF tekućinama najniže razine kvalitete koja zadovoljava danas već nevažeću GM Type A Suffix A specifikaciju. Potrošnja standardne srednje razine kvalitete (DEXRON II) je u laganom porastu.

ZUPČANIČKA ULJA ZA VOZILA

Novi zahtjevi za kvalitetom zupčaničkih ulja prezentirani su odnedavno poznatim specifikacijama renomiranih proizvođača zupčaničkih sustava i vozila prvenstveno u Europi. Može se reći da je u zadnjih nekoliko godina uočena nagla promjena kvalitete u specifikacijama europskih konstruktora i proizvođača kao rezultat zahtjeva za štednjom goriva, promjene konstrukcija i uvođenja novih materijala (sinkroni) uz izražene zahtjeve za produženim intervalom izmjene ulja i većim korištenjem maziva za cijeli (procijenjeni) radni vijek vozila[4]. Gotovo svi europski konstruktori i proizvođači preporučuju u novim formulacijama veće korištenje PAO i odobrene nove tehnologije aditiva. Svi su izrijekom složni da se u novim modernim formulacijama zupčaničkih ulja ne preporuča korištenje hidrokrekiranih ili esterskih baznih ulja.

Tablica 8: Procjena potrošnje zupčaničkih ulja (za diferencijal i zadnji most) na tržištu Hrvatske po razinama kvalitete za razdoblje 1998.-2000. %

Klasa	Razina kvalitete	1998.	1999.	2000.
I vrhunska ulja sintetika, polusintetika SAE 75W	MB 235.8 i 235.9 MAN 342 Type TL i SL ZF TE-ML 05 A i B, 12 A i B (produženi interval zamjene)	0	0	<1
II visoka kvaliteta produženi interval zamjene SAE 80W, 90, 80W-90, 85W-140	MB 235.0 MAN 342 Type N ZF TE-ML 05A, 07A, 12A Nadilazi API GL-5	do 5	5-10	15-20
III fighting grade SAE 80W, 90, 80W-90, 85W-140	API GL-5	95	90-95	80-85

Procjena za naredno razdoblje u području zupčaničkih ulja

Očekivani veliki porast troškova ispitivanja, troškova homologacija i općenito veliki troškovi razvoja zupčaničkih ulja dovest će do redukcije broja tvrtki proizvođača aditiva i maziva koje će moći pratiti sve strože zahtjeve automobilske industrije. Međutim, u većem broju zemalja Europe, a to znači Hrvatska i šira regija, gdje još postoji relativno stariji vozni park, zupčanička ulja na mineralnoj osnovi još će barem 10 godina dominirati na tržištu u odnosu na više razine kvalitete. Procjena je, naime, da potrošnja sintetičkih ili polusintetičkih zupčaničkih ulja u Hrvatskoj i široj regiji u 5 godina neće prijeći više od 5% udjela na tržištu. To se može vidjeti iz tablice 8 na primjeru procjene potrošnje zupčaničkih ulja samo za zupčanička ulja za diferencijal i zadnji most za zadnje 3 godine.

TEKUĆINE ZA KOČNIČKE SUSTAVE

Vodeći proizvođači vozila i kočničkih sustava prednjače u dramatičnom razvoju modernih konstrukcija kočničkih sustava. Za sve njih cilj je poboljšanje sigurnosti u vožnji kao osnova njihove marketinške strategije radi dobivanja povjerenja krajnjih korisnika-kupaca novih vozila. U tome prednjače, u smislu značajnog razvoja kočničkih sustava, europski proizvođači vozila kao što su npr. BMW, Opel i VW[4]. Visokosofisticirani sustavi elektronike za sustave kočenja, sustav ABS ili noviji ASR samo stavljaju pred proizvođače modernih tekućina za kočničke sustave nove strože i katkad dijametralno suprotne zahtjeve. Ipak ovi trendovi mogu se sumirati u dva osnovna zahtjeva. To je zahtjev za niskom viskoznošću, posebno kod vozila koja posjeduju ASR sustave te općeniti zahtjev za štednjom energije.

Tablica 9: Usporedba specifikacija i osnovnih zahtjeva tekućina za kočničke sustave

SVOJSTVA	SAE J1703	ISO 4925	FMVSS 116		
			DOT 3	DOT 4	DOT 5
Vrelište, °C, najmanje	205	205	205	230	260
Vlažno vrelište, °C, najmanje	140	140	140	155	180
Kinematička viskoznost kod -40 °C, mm^2/s, najviše	1800	1500	1500	1800	900

Međutim, najvažnija činjenica koja će dalekosežno utjecati na tržište kočničkih tekućina je na neki način zajednička odluka svih proizvođača vozila da u svojim vozilima stavljaju u prvo i servisno punjenje samo jednu najvišu odobrenu kvalitetu. Osim toga ta preporuka će važiti za sve tipove njihovih vozila u servisu.

Tablica 10: Pregled novih zahtjeva europskih konstruktora i proizvođača vozila za kočničke tekućine

Specifikacija europskih OEM	Napomena - zahtjev
VW DOT 501.1	VW prelazi do kraja godine u svim vozilima na korištenje najviše razine kvalitete, bez izdavanja dopuštenja za primjenu
OPEL, BMW	Vlažno vrelište najmanje 170°C Suho vrelište najmanje 265°C KV (-40 °C) =najviše 800 mm^2/s
MB	Zahtjevi iznad DOT 4 Vlažno vrelište najmanje 180 °C Moguće je dobiti Rebrand approval
VOLVO	Zahtjevi iznad DOT 4 Vlažno vrelište najmanje 200 °C Suho vrelište najmanje 300 °C KV (-40 °C) =najviše 1400

TEKUĆINE ZA RASHLADNE SUSTAVE MOTORA VOZILA[4]

Na tržištu tekućina za prijenos topline koja se koriste u rashladnim sustavima motora vozila vlada već duže vrijeme određen nesklad između različitih smjerova razvoja koji se vidi kroz usporedbu različitih zahtjeva bezbroj specifikacija konstruktora i proizvođača vozila. Međutim ipak možemo reći da postoji određena sukladnost u različitim pristupima, obilježjima pa i smjernicama razvoja između japanskih konstruktora i proizvođača s jedne strane, američkih s druge i ono što je nama najvažnije europskih konstruktora i proizvođača s treće strane.

Može se reći da u Europi u pogledu tipa tekućine za rashladne sustave motora vozila prevladava u tvorničkom i servisnom punjenju beznitritni antifriz, tzv. nitrit-frei-antifriz, tj. antifriz koji uz obavezni MEG ne sadrži nitritne spojeve u paketu inhibitora korozije. Takva kvaliteta preporučuje se od cca 80% europskih konstruktora i proizvođača, a u Njemačkoj gotovo

100%. Valja spomenuti da su iznimka u Europi francuski proizvođači PSA i Renault koji također preporučuju posebne formulacije na osnovi MEG-a bez nitrita. Međutim dopušteni paketi inhibitora kod francuskih konstruktora i proizvođača su bitno drukčiji od onih koji se koriste u formulacijama antifriza bez nitrita kao npr. u vozilima njemačkih konstruktora i proizvođača te uopće nisu kompatibilni. Ono što je novo i što je postao problem kod većine europskih konstruktora i proizvođača jest trend nešto većeg korištenja tzv. formulacija bez silikata, tj. antifriza na osnovi MEG-a i paketa inhibitora korozije koji ne sadržavaju silikatne spojeve. Ove nove formulacije odobrila je većina renomiranih ne samo europskih konstruktora i proizvođača, ali što je važno istaći istovremeno i za iste rashladne sustave vozila kao i formulacije bez nitrita.

Iako postoje različita stajališta, ipak do danas nije potpuno razjašnjeno pitanje kompatibilnosti formulacija bez nitrita i bez silikata. Najbolji dokaz tome je zahtjev i preporuka VW-a da se kod primjene jedne od dviju specifikacija G11 (nitrit-frei) i G12 (silicat-frei) izričito zabranjuje međusobno miješanje. Navedene formulacije bez silikata koriste se trenutačno, najviše u Sjevernoj Americi temeljem preporuka američkih konstruktora i proizvođača (npr. Ford i američki dio Daimler-Chryslera).

S druge strane, još jedna specifičnost ovog tržišta jest i u tome da neki proizvođači teško opterećenih motora/vozila, kao što je američki Caterpillar, i dalje koriste dosta zastarjele formulacije s relativno velikim sadržajem nitrita ali s manjim sadržajem silikatnih spojeva u odobrenim paketima inhibitora korozije.

Što se tiče produženog intervala zamjene, većina konstruktora i proizvođača deklarira kod primjene beznitritne formulacije barem 3-5 godina kao minimalno vrijeme korištenja, dok za bezsilikatne oko 5 godina. Valja spomenuti da je već duže vrijeme tabu-tema razvoj formulacija antifriza for-life, tj. mogućnost produženja vijeka trajanja antifriza u rashladnom sustavu motora vozila na npr. 15 godina. Veliki otpor ovakvom smjeru razvoja daju vrlo utjecajne servisne organizacije, osobito u Njemačkoj, koje ne vide svoj interes u nekontroliranom razvoju i to ne samo tekućina za rashladne sustave već i maziva i srodnih proizvoda za čitav radni vijek vozila.

KLJUČNI ZAHTJEVI ZA INDUSTRIJSKA ULJA U HRVATSKOJ

Kod industrijskih ulja već duže vrijeme je prisutan zahtjev za većom produktivnošću koji se očituje u izraženim zahtjevima za produženjem

intervala zamjene ulja u industrijskim sustavima, smanjenjem zastoja opreme i općenito prevladavajućim zahtjevom za smanjenjem ukupnih troškova održavanja. Također, sve više se koriste samo u zemljama razvijene Europe biorazgradljiva maziva i maziva koja manje ugrožavaju okoliš.

Što se tiče Hrvatske, uočen je određen početak industrijske obnove. Procjena je da je stopa rasta industrije u Hrvatskoj prosječno 2.9%, barem što se tiče 9 glavnih grana industrije u kojima se maziva nešto više koriste od ostalih. Polagani rast proizvodnje temelji se na pojavi novih tvrtki ili promjeni vlasničke strukture koja onda rezultira uvođenjem novih strojeva, a to znači i pojavu novih specifikacija i zahtjeva za radnim svojstvima.

Na primjeru industrije obradbe metala u Hrvatskoj mogu se detaljnije prikazati novi trendovi glede zahtjeva za kvalitetom koji su i inače specifični za slična tržišta-regije zemalja u tranziciji. U industriji obradbe metala dominiraju sljedeći ključni zahtjevi za radne tekućine (TOM). To su:

- poboljšanje radnih svojstava
- veće brzine obradbe i brzine dobave TOM
- zahtjev za smanjenjem potrošnje TOM
- organizacija cijelog sustava neštetnog uklanjanja rabljenih i otpadnih maziva (skupljanje, selektivno odvajanje, provjera statusa - laboratorijska analiza, ponovna prerada i konačno neštetno kontrolirano odlaganje).

Ovaj zadnji zahtjev vrijedi općenito i za ostale tipove industrijskih maziva. Međutim, otežavajuća je činjenica da je industrija obradbe metala u Hrvatskoj u vrlo teškom stanju. Financijski problemi su veliki, a samim tim kvaliteta TOM je u drugom planu. Rukovodeći menadžment ne razmišlja mnogo o primjeni modernih i ponekad skupljih proizvoda (po kg) u svjetlu potrebe smanjenja ukupnih troškova održavanja.

MAZIVE MASTI

Trendovi u pogledu novih razina kvalitete, novih zahtjeva za kvalitetom, novih specifikacija i metoda ispitivanja kao i uvijek rezultat su u prvom redu pojave nove konstrukcije sustava u kojima se koriste mazive masti. Na primjeru ležaja za industriju i vozila uočen je veliki napredak i to pojavom novih materijala i konstrukcija košuljica ležaja i konusnih valjnih ležaja koji su rezultirali novim zahtjevima u primjeni. U razvoju novih konstrukcija ležaja za potrebe osobnih i komercijalnih vozila i u željezničkom transportu posebno prednjači njemački FAG[4]. Novi testovi ispitivanja radnih svojstava i posebno

visokotemperaturnih svojstava masti kao što su FAG FE8 i drugi FAG testovi znače i nova pravila igre. Nove masti više nije moguće razviti, homologirati, a to znači ni prodavati na tržištu bez provođenja potrebnih ispitivanja. To je samo jedan primjer porasta troškova ispitivanja (oba testa za jednu mast koštaju barem 25.000 DEM). Nadalje, vodeći konstruktori sustava, npr. ležaja, preporučuju da se za nove konstrukcije koriste potpuno sintetičke ili djelomično sintetičke mazive masti. Međutim, naglasak je na tome da se zabranjuje korištenje esterskih i hidrokrekiranih baznih ulja, a prednost se daje baznim uljima IV grupe, tj. PAO.

Dobra vijest je da će konačno možda biti ispunjen vakuum zbog nedostataka službene klasifikacije i mogućnosti registracije tzv. "food-grade" mazivih masti za prehrambenu industriju. Naime, radna grupa ELGI / NLGI / EHEDG nastoji stvoriti sustav klasifikacije i registracije "food-grade" mazivih masti kao zamjene za USDA H1/H2 1999[5] - Procedural Requirement for the Registration of FGL 1/2000 Issue 1. Osim toga, nacrt norme DIN V 01517[6] odobrio je njemački komitet za higijenu hrane u travnju 2001. godine.

PREGLED TRENDOVA U PROIZVODNJI BAZNIH ULJA[7,8]

Zbog različitih razloga, u prvom redu zbog očekivane promjene i racionalizacije programa maziva po pojedinim tržištima razvijene Europe, ali i svijeta i interesa velikih naftnih kompanija vlasnika novih tehnologija za proizvodnju baznih ulja grupa II i III doći će do promjene strukture potrošnje baznih ulja u razvijenoj Europi do 2005. godine. Ovaj trend u pogledu porasta potrošnje grupe III u svijetu temelji se i bit će uvjetovan slijedećim:

- povećanom primjenom formulacija prema specifikaciji GF-3, gradacije SAE 5W-30,
- potrebom zamjene PAO (cijena, konkurentnost, posjedovanje tehnologije za II, II+ i III grupu),
- specifičnim zahtjevima europskih konstruktora i proizvođača
- interesom ograničenog broja proizvođača i vlasnika tehnologije 1. i 2. generacije (grupa II i III),
- postojećim ograničenjem za grupu III.

Ono što se može prognozirati jest da će ubuduće biti prihvaćena visoka cijena koja je poduprta kvalitetom. U razvijenoj Europi, a posebno u europskim zemljama u tranziciji, bit će osjetno manji rast potrošnje ulja iz grupe II i III. Ali, dok se na tržištima razvijene Europe pod utjecajem konstruktora i proizvođača i pojave novih modernih vozila i industrijske opreme daje prednost primjeni PAO, kod europskih zemalja u tranziciji će

također biti nešto manja potrošnja baznih ulja iz grupe II i III, ne samo zbog visoke cijene baznih ulja nego i zbog strukture tržišta i zahtjeva za kvalitetom. Može se konstatirati temeljem postojećih podataka[7] da samo 10% europskih rafinerija do 2005. godine može zadovoljiti zahtjeve za kvalitetom i asortimanom palete baznih ulja što će imati dalekosežnu posljedicu na poslovanje naftnih kompanija. Nadalje, može se očekivati da će se cijena baznih ulja mijenjati u skladu s promjenom cijena nafte.

Iz tablice 11 vidi se da će u narednom razdoblju doći do povećane proizvodnje i ponude tzv. nekonvencionalnih mineralnih ulja, najprije iz grupe II, II+ i III čija će cijena u početku zbog velike ponude biti manja od realne.

Tablica 11: Promjena potrošnje baznih ulja u razvijenoj Europi do 2005. g.

Grupa	Tip baznog ulja	Potrošnja	Kapaciteti
I	Mineralna bazna ulja	Pad do 3 % (kao i u svijetu)	Smanjenje na 80 %
II	Nekonvencionalna mineralna bazna ulja	Porast od 4 do 5,5%	Porast do 16%
III	Nekonvencionalna mineralna bazna ulja s visokim IV (>120)	Porast od 9 do 16 %	Porast do 6 %/

UTJECAJ TRENDOVA U SVIJETU NA TRŽIŠNE UVJETE U REGIJI[9]

Zbog dramatičnog povećanja troškova ispitivanja, razvoja novih konstrukcija, novih zahtjeva za kvalitetom, u čemu prednjači zahtjev za produženjem vijeka (zamjene) trajanja ulja, očekuje se na svjetskoj razini nakon 2002. godine pad potrošnje maziva tempom od 1-2% godišnje. Nadalje, sve više će se zaoštravati odnosi na relaciji konstruktori i proizvođači vozila - proizvođači maziva - proizvođači aditiva - servisne organizacije. U vezi s tim doći će na nekim razvijenim i manje razvijenim tržištima do porasta prodaje originalnih ulja pod imenom OEM-a (Ford, GM, Daimler-Chrysler, VW) čime proizvođači vozila ulaze u poslovanje mazivima i počinju mijenjati postojeće odnose. To će sve imati utjecaj na intenziviranje trenda povećane isporuke tzv. "Premium global - branded products" iz drugih regija, dakle lokacija "velikih", dok će proizvodnja maziva niže razine kvalitete ili "Low-quality products - Fighting grade" - biti koncentrirana u regiji.

Samom promjenom uvjeta poslovanja, globalizacijom ili i zbog specifičnosti pojedinih tržišta doći će do porasta tj. pojava novih tvrtki nazivno prodavača maziva, i do 2%. Međutim, za razliku od prije dominirat će i preživjeti samo

one nove tvrtke koje posjeduju sve bitne, tj. primarne aktivnosti unutar tvrtke. Te aktivnosti su osim prodaje primjensko-tehnički servis, primjenski razvoj i proizvodnja-blending. Dakle, sve će više biti prisutan utjecaj prevelikih proizvodnih kapaciteta. To će dovesti do ograničenja investicija, a to će stvoriti pritisak na postojeće tehnološke mogućnosti. Kako su maziva kao djelatnost po definiciji uslužna djelatnost, imperativ učinkovitosti poslovanja koji će biti postavljen pred rukovodstva starih ali i novih tvrtki bit će obveza smanjenja ukupnih troškova proizvodnje (Total product cost).

Sljedeći važni trend ili bolje rečeno konstatacija je ocjena rukovodstva koja neminovno utječe na strategiju poslovanja. Doba borbe za marku je prošlo. Naime, danas sve ozbiljne tvrtke proizvođači maziva ulažu ogromna sredstva u promidžbu, homologacije, skupa praktična i laboratorijska ispitivanja i sl. Dominacija, poboljšanje pozicije ili zadržavanje vodstva na nekom tržištu danas je prvenstveno pitanje najbolje logistike[10], a ne najbolje promidžbe. Većina velikih tvrtki danas preispituje svoje ogromne troškove ulaganja u nova tržišta promidžbom vrhunskih marki jer se uloženi kapital prodajom top-tier proizvoda nije vratio. Doći će do potrebe bolje i stručnije organizacije logistike s naglaskom na potrebu provođenja različitih integracija uz obvezu dovođenja kanala nabave na viši stupanj povezanosti, proizvodnje, prodaje i krajnjih korisnika. Danas je više nego očito da je ključ preživljavanja manjih ili većih tvrtki u fleksibilnosti proizvodnje s naglaskom na rješavanje uskih grla – uz što manje troškove i što veću brzinu prilagodbe. Doći će do podjele postojećih kompanija, tj. tvrtki proizvođača maziva na:

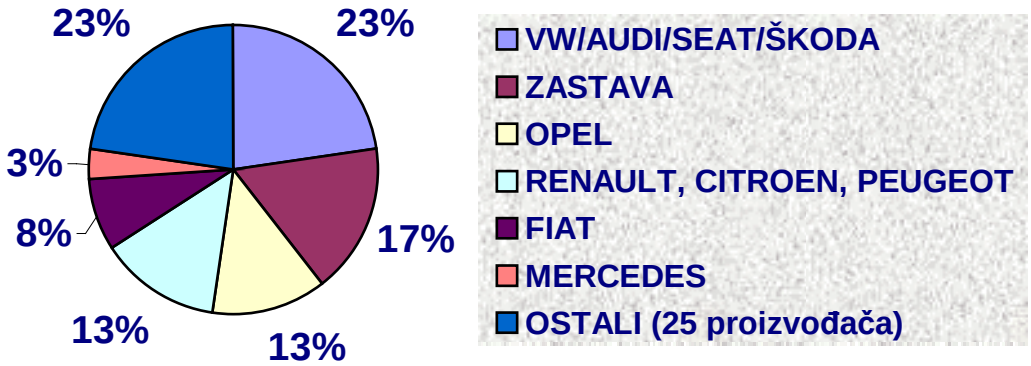
1. Tvrtke sa svim potrebnim djelatnostima koje će morati ozbiljno razmotriti poslovanje i organizaciju poslovanja uz potrebu racionalizacije u poslovanju - "strike a balance".
2. Manje regionalne tvrtke koje će biti prisiljene na brak s jačima, uz nesigurnu i tešku borbu za opstanak.

Zaključne napomene:

1. Prodaja maziva i dalje je jedan od najprofitabilnijih biznisa u naftnoj industriji.
2. U pogledu asortimana i kvalitete maziva i srodnih proizvoda tržište Hrvatske prati trendove tržišta razvijene Europe.
3. U ponudi dominiraju maziva niže i/ili srednje razine kvalitete na mineralnoj osnovi (60-90%).

4. Potrebe za vrhunskim (top-tier), uglavnom sintetičkim i polusintetičkim mazivima, trenutačno jesu i bit će u narednom razdoblju od 1do 5% od ukupne potrošnje, ovisno o tipu ili grupi maziva.
5. U sljedećem razdoblju doći će do racionalizacije programa maziva i brže prilagodbe zahtjevima tržišta.
6. U formulacijama vrhunskih maziva više će se koristiti PAO dok će se primjena hidrokrekiranih baznih ulja ograničiti uglavnom na motorna ulja više razine kvalitete i kod industrijskih uglavnom za turbinska ulja više razine kvalitete.
7. Velike globalne tvrtke-proizvođači maziva završile su fazu prvih osvajanja sekundarnih tržišta uz nametanje svoje poznate globalne marke. Naučili su lekciju, tj. nisu zadovoljne ostvarenim profitom od prodaje "premium ili top-tier" kvalitete u odnosu na uložena sredstva.
8. U sljedećih desetak godina na tržištu Republike Hrvatske prevladavat će borba za najpovoljniju logistiku prodaje, ali regionalne tvrtke će morati i dalje uporno i strpljivo graditi prepoznatljivu, originalnu i prihvatljivu marku maziva (tvrtke).
9. Fleksibilnost, isporuka na vrijeme i općenito brzi odgovori zahtjevima tržišta su ključ preživljavanja manjih ali i većih regionalnih tvrtki (reorganizacija u hodu).

Slika 1: Osobna vozila -Zastupljenost proizvoađa na tržištu Hrvatske
Figure 1: Passenger car – OEM's share on Croatian market



Slika 2: Teška gospodarska vozila preko 3.5 t (TGV) – Zastupljenost proizvođača na tržištu Hrvatske

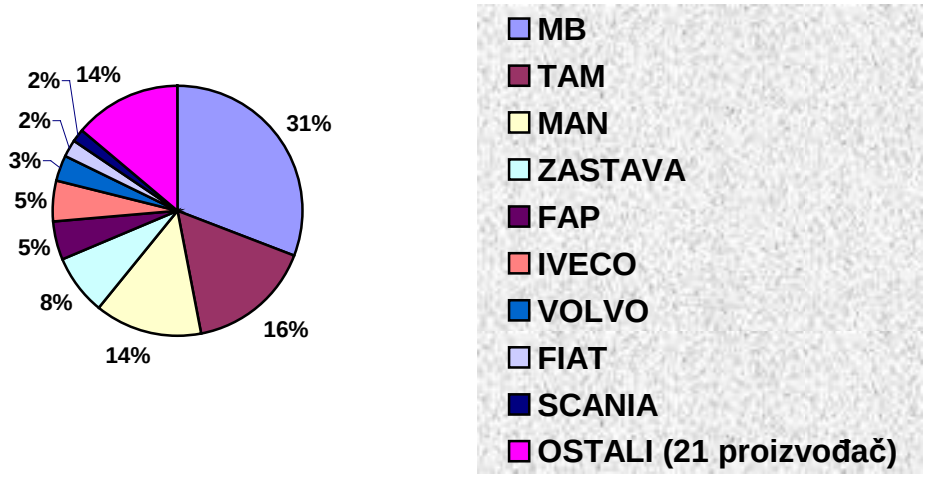
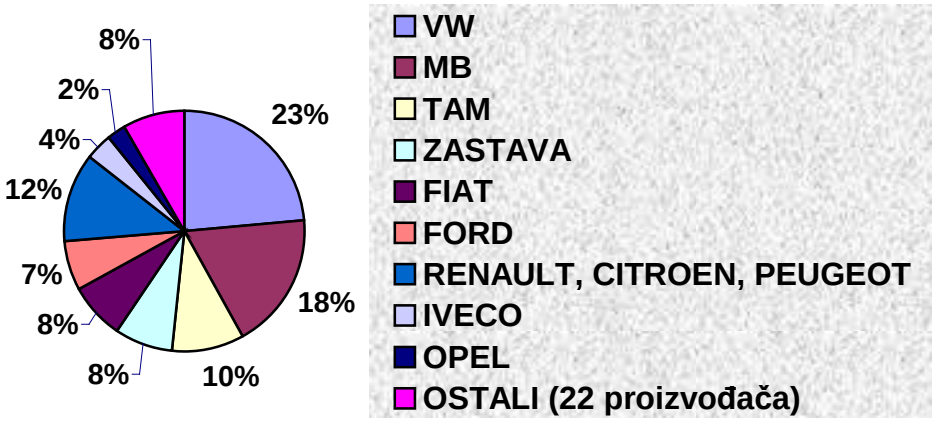


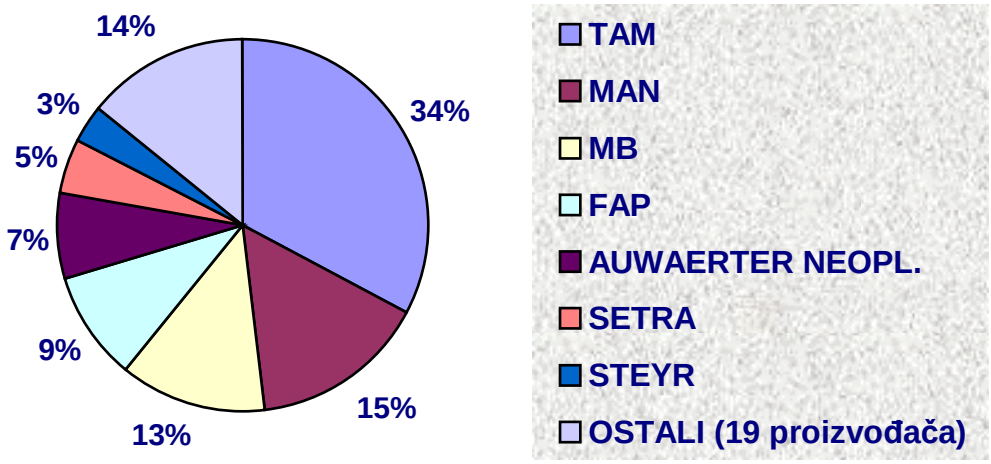
Figure 2: Heavy-duty commercial vehicle (over 3,5T) - OEM's share on Croatian market

Slika 3: Laka gospodarska vozila do 3.5 t (TGV) -Zastupljenost proizvođača na tržištu Hrvatske
Figure 3: Light commercial vehicles (till 3,5T) - OEM's share on Croatian market

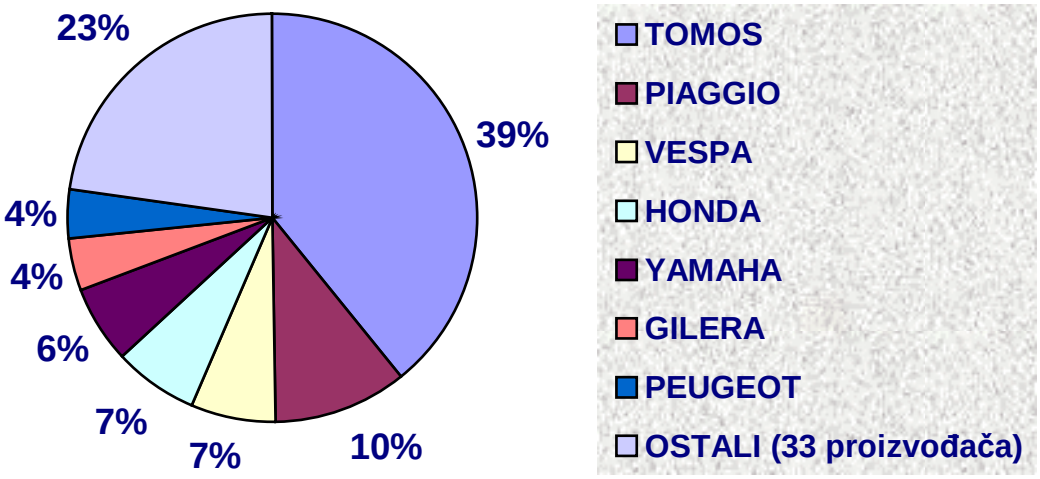


Slika 4: Autobusi - Zastupljenost proizvođača u Republici Hrvatskoj

Figure 4: Buses - OEM's share on Croatian market



Slika 5: Mopedi i motocikli - Zastupljenost proizvođača u Republici HrvatskojFigure 5: Mopeds and motorcycles -- OEM's share on Croatian market



IMPACT OF EUROPEAN QUALITY REQUIREMENTS AND GUIDELINES FOR LUBRICANT DEVELOPMENT IN CROATIA

Abstract

There is a rather favourable trend of the renewal of the motor pool of passenger cars, light commercial vehicles (LCV) and motorcycles in the Republic of Croatia, however, heavy commercial vehicles (over 3.5 to) and the industrial pool are renewing more slowly. That fact has a certain effect on the speed of accepting the trend of changes and introduction of new levels of lubricants quality.

This paper gives a short survey of the main requirements for the quality of lubricants and similar products, particularly those dictated by European OEMs, i.e. original manufacturers of vehicles, the equipment for vehicles and the industrial equipment and their possible effect on the lubricants market in Croatia.

Also, an appraisal of the change of the lubricants assortment by types in the last three years is given, as well as an example of the effect of new lubricants specifications. The effect of trends in the field of quality and application of various classes of base oils and the expected trend of the implementation in modern lubricant formulations are also considered. In the end, the effect and specific characteristics of the environment in the lubricants business in Croatia were considered, with an emphasis on the world trends.

The presented guidelines of the possible development of the lubricants market and business in Croatia are primarily the conclusions by the author based on the appraised speed of the change and the possibilities of the market to accept the European trends.

CAPACITY AND INTENSITY OF VEHICLES POOL RENEWAL IN REPUBLIC OF CROATIA

For the purpose of getting an insight in the current presence of vehicle manufacturers in Croatia, an analysis of the shares based on the situation during the year 2000[1] was made. Thus, it is evident from Figure 1 that ZASTAVA vehicles are still most present. However, if we look at the vehicles from the VW/SEAT/ŠKODA/AUDI group, then this mega-manufacturer is in the first place. The presence of OPEL, and GM, in general, as well as the associated French producers is also very big. The age of vehicles is another important factor, which is not the subject of this paper for various reasons, but it is sufficient to say that the vehicles made by ZASTAVA have the lead with respect to their oldness. On the other side, the question is raised how many of these oldest vehicles, registered ones, are in traffic at all. The presence of some 30 brands of manufacturers is the factor which can mean only more possibilities for the renewal of the vehicles pool. It is expected that vehicles by European OEM producers keep their prevalence, with a somewhat bigger share of French producers than it has been the case until now.

From Figure 2 it is evident that, as expected, Mercedes-Benz, i.e. Daimler-Chrysler vehicles lead in the field of heavy commercial vehicles (HCV), thus, commercial vehicles with the carrying capacity above 3.5 t. Immediately next to them are, as expected, MAN and TAM vehicles. A large number of brands is also present here, and in future it is expected that manufacturers such as VOLVO, IVECO and SCANIA would get a bigger share in the market within the renewal of the stated vehicle pool. In the field of LCVs, there are over 30 brands, VW and MB have the lead, followed by somewhat older TAM and ZASTAVA vehicles. The intensity of the renewal is somewhat quicker here and it can be expected that a further change in the share of the market will arise in future. A bigger share of the French manufacturers and the FIAT company is expected.

From Figure 4, it is evident that the company TAM is still dominant regarding buses, and that the future presence of bus types in the market of Croatia is very difficult to predict. The biggest "boom" and opening of the vehicle market and the replacement intensity happened in the field of mopeds and motorcycles. The reason for that is not only the acceptability of the prices of (two-wheeled) vehicles, but also a certain inclination of the drivers mentality and the climate conditions, particularly in Dalmatia.

The vehicle manufacturer TOMOS, now in the position of the leader in the Croatian market, will have big problems in future due to aggressive approaches and winning of the market primarily by companies such as PIAGGIO, VESPA, GILLERA and PEUGEOT.

To sum up the presence of vehicles, it is evident that, as expected, in the total number of vehicles (Table 1) the largest number of vehicles is in the field of passenger cars. It is further evident that the concentration of vehicles is the highest in the wider Zagreb region, and that the highest renewal intensity (up to 10%) is expected in the field of mopeds and motorcycles, passenger cars and perhaps buses.

It should be mentioned on the example of passenger cars that the expected capacity of the renewal, of about 120,000-130,000 vehicles, still has not been reached. Namely, already for several years, that figure has been mentioned regardless whether new cars or used vehicles are in question, while the registration of new vehicles has never exceeded the figure of 60,000. The realization of that nominal or estimated capacity of the renewal depends directly on the economic situation, the living standard of potential owners of passenger cars and only after that on the competitiveness, the offer and the terms of sale of vehicles.

Table 1: Vehicle pool in Croatia (as of December 31, 2000)[1]

Vehicle Type	Number of Vehicles	Zagreb Region	Renewal Average 1996/2000	Estimated Renewal Intensity per Year
	Units	%	%	%
Passenger cars	1,130,828	35	3.5 - 4.5	10
Heavy-duty vehicles (over 3.5 t)	28,953	26	1.0 – 2.0	8
Light commercial vehicles (up to 3.5 t)	84,211	30	2.5 - 5.5	5
Buses	4,658	23	do 1.5	10
Mopeds and motorcycles	65, 025	16.5	4.5 – 8.5	10
Total	1,313,675			

The datum which is already available for public that the average oldness of the vehicle pool, i.e. vehicles is about 11.3 years does not mean anything in the marketing sense, since a particular analysis by types and brands of vehicles is important. What can be seen in Table 2 indicates a rough division

into three groups of vehicles by their age, i.e. the classification of vehicles by oldness. It is evident that about 50% of the vehicles is older than 10 years in the group of passenger cars and mopeds and motorcycles, thus, vehicles for personal needs. On the other side, among the vehicles which are predominantly in the company ownership, thus, which are mostly used for commercial purposes, there are from 60 to 80% of vehicles older than 10 years. More thorough analyses of these data and of additional data can surely give good quality information to lubricant vendours in the sense of adapting and defining the marketing strategy and the sales assortment for the market of Croatia.

Table 2: Vehicle oldness in Croatia (%)[1]

Vehicle type	1 to 5 years	5 to 10 years	10 years or more
	%	%	%
Passenger cars	18.5	26.0	55.5
Heavy-duty vehicles	7.5	14.5	78.0
Light commercial vehicles	18.5	22.5	59.0
Buses	7.5	27.5	65.0
Mopeds and motorcycles	35.0	20.0	45.0

MAIN REQUIREMENTS FOR ENGINE OILS IN EUROPE

The offer of lubricants in a market, in this case, engine oils or oils and liquids for engines and motor vehicles in general, is affected primarily by the specifications of original manufacturers of vehicles and the equipment for vehicles, the oldness, the number of brands and the distribution of the existing vehicle pool. In accordance with that, the trends arising in developed Europe regarding the requirements for the lubricant quality have, more or less, a direct influence on the change of the program and offer of lubricants in a particular regional market.

In that respect, some of the latest requirements for the quality of engine oils can be stated, which will positively have an effect on the market of Croatia. These primarily European trends-guidelines for the development and improvement of the quality and commercial programs of lubricants will, in accordance with the change of the vehicle pool, i.e. the intensity of the renewal, be realized with the majority of lubricant vendours in the market of

Croatia very quickly. The latest requirements for oils for engines and motor vehicles are as follows:

- **Reduction of exhaust gases emission**

The development of engine designs goes in the direction of improved (gasoline and diesel) engine properties, on one side, and the quality of engine oils, on the other side, based on a better quality of engine oils with the common final goal of saving, i.e. a better fuel efficiency during driving and using of vehicles.

- **Prolongation of the interval for oil change for passenger cars**

Most of the renowned manufacturers state and require the use of oil with the prolonged oil change interval for passengers cars from 15 to 30,000 km, which is evident in Table 4. In some cases, that interval of change is averagely prolonged to 30,000 and even up to 50,000 of km driven. However, the recommendation that oil is to be changed at least once annually is still valid.

- **Prolongation of the oil change interval for heavy-duty commercial vehicles**

Most of the renowned manufacturers of heavy-duty vehicles state and require the use of the oil with the prolonged oil change interval which exceeds even 100,000 kilometres of driving for some new vehicles. However, that prolonged interval is required only in case of some new vehicle types with specified limitations or special requirements (see Table 5), like, primarily, the obligatory use of best quality low-sulphur fuels and carrying out of special "flexible servicing".

- **Improved performance at lower and increased working temperatures**

These new requirements are the result of the desire of vehicle designers for better engine protection, as well as the request for ensuring better required driving performances of a vehicle.

- **Better oxidation-thermal features, as well as better EP features**

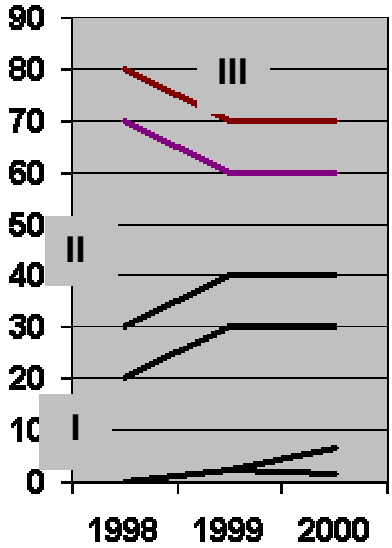
More perfect engine designs, primarily, a smaller engine displacement, a higher output power, higher driving speeds, smaller vehicles, more Diesel engines, a smaller possibility of lubricant leakage have an effect on particular requirements such as: a smaller quantity of oil filling. In general, the result of these effects of new requirements – new designs is a higher load on the greasing layer and a more often exposure of lubricants to higher thermal shocks.

As the result, several new specifications, requirements regarding the quality of engine oil for passenger cars arose which are presented in Table 3.

Table 3: New specifications for passenger car engine oils

VW 503.00	Oils for gasoline engines, the requirement for low viscosity, the prolonged oil change interval up to 30,000 km
VW 503.01	The same as VW 503.00, only with a special requirement for AUDI
VW 506.00	Oils for passenger cars with Diesel engines, the prolonged oil change interval up to 50,000 km, but not for engines with the fuel injection system
VW 506.01	Oils for Diesel engines with the improved wear protection and the prolonged oil change interval up to 50,000 km A3/B4 base plus special VW tests
MB 229.5	Oil with several gradations (SAE 0W-X, 5W-X, 10W-X), the prolonged oil change interval up to 50,000 km ACEA A3,B3, B4 (1999) base plus MB engine tests and special in-house tests and practical examinations
BMW Longlife Oil	ACEA A3/B3 base plus BMW M52 test, oil change interval of 20,000 ± 5,000 km
BMW factory Oil from 3/2000	ACEA A3/B4 base
PORSCHE Service Fill	ACEA A3 base, approved grades SAE 0W-40, 5W-40, 10W-40, 5W-50, 10W-50

Table 4: Consumption estimate of passenger car engine oil in the Croatian market (%) per quality level type



Class	Quality level	1998.	1999.	2000.
I top tier (top quality) oil synthetic	ACEA A3/B3/B4-98 VW 502.00/505.00 BMW Longlife	0	about 2.5	1.5-6.5
II middle and higher quality, semi-synthetic	ACEA A3/B3-96 VW.500.00/505.00 API SJ/CF	20-30	30-40	30-40 (approx. 75)
III Fighting grade mineral base	API SG/CD or less CCMC G4/PD2	70-80	60-70	60-70 (approx. 25)

However, if we look at the state in Croatia regarding the consumption of engine oils by the levels of quality, which is presented in Table 4, it is seen that there is the biggest consumption of the type 3 or fighting-grade oil, thus the engine oil of the lowest level of quality with the most favourable commercial offer. That consumption was somewhat lower in the last 2-3 years in favour of the consumption of a higher quality oils, but it still represents over 60% of the total market. Still, it is positive that in the last year and a half, the consumption of the high quality synthetic engine oil has increased. Yet, this analysis by the random sample method shows that the majority of engine oil vendours (at 23 brands) do not have all the necessary types, but most often offer only two qualities in several grades (figures in brackets, column 3 for the year 2000), and that they put the emphasis on the promotion and sale of middle-quality oils, regardless of the technical servicing and the actual needs of the buyer.

Table 5: Review of increase of oil change interval for heavy-duty vehicles of European OEMs

OEM	Longest recommended oil change interval	Level of quality /specification	Remark
MB	100,000 km	MB 228.5	For ACTROS trucks
IVECO	100,000 km	E5	EURO III f with TI liquid filter
MAN	80,000 km	M 3277	TGA, has built-in EGR EURO III by-pass filter
DAF	100,000 km	E4	by-pass filter
RVI	60,000 km	RLD	
SCANIA	120.000 km	LDF	
VOLVO	100,000 km	VDS-3	EURO III

Increase of the engine oil change interval for commercial vehicles

As it was said and stated in table 5, the prolongation of the engine oil change for heavy-duty vehicles is possible only with carrying out of special vehicle servicing and using of the best quality low-sulphur fuels. However, it should be pointed out that the basis, or, better, the precondition for achieving that is primarily using of the best, top engine oil formulations. Such "top-tier" oils (UHPD quality, see Table 6), are formulated on the basis

of non-conventional base oils of the high IV and/or synthetic base oils. The formulations must ensure a better oxidation and thermal stability, and the commercial side of the whole story is in the fuel efficiency.
Sooner or later, as the consequence of these trends, an increase in the price of lubricants and the increase of the expenses for lubricants testing will occur in various markets, which will have a direct influence on the change of business conditions in the market of lubricants. In accordance with specific features of particular markets, most of vendours and producers of lubricants will have to carry out the rationalization of the commercial program of engine oils for commercial vehicles, but also for passenger cars.

Table 6: Estimate of oil consumption for heavy-duty commercial vehicles on Croatian market by quality levels for the period 1998-2000 (%)

Class	Quality Level	1998.	1999.	2000.
I top-tier oils UHPD semi-synthetic	ACEA E4-98 SAE 10W-40, 5W-40, 5W-30 MB 228.5 MAN 3277 VOLVO VDS-2 MTU-Type 3	0	0	0.5 do 1.0
II high quality SHPD mineral base	ACEA E3 isuue 2 SAE 15W-40 10W-40, 10W-30 MB 228.3 MAN M 3275 IVECO T-2 API CE/CF/SF	2.6	16.2	20-25 (5 –90)
III good quality mineral base	ACEA E2 ACEA E1-issue 2 SAE 15W-40 VOLVO VDS IVECO T-1 API CF/CF-4/SG	30	25	do 20 (2-45)
IV fighting grade mineral base	without ACEA requirement SAE 15W-40 ZF TE-ML 03A API CD or lower	65	50	45-50

Global DHD-1 – New recommendation for quality level of heavy-duty Diesel engines[2,3]

The draft of the new specification was presented by the middle of 2000 in Paris at the CEC/SAE symposium. This specification is the result of the mutual development and the agreement of renowned professional trade associations: ACEA (European Manufacturers Association), EMA (Engine Manufacturers Association) and JAMA (Japan Automobile Manufacturers Association). The common goal of the stated organizations was an attempt of creating of a world accepted (global) specification, which will primarily meet the globally accepted requirements for the reduction of the emission of exhaust gases set already in 1998. The goal was also that the expenses for testing and homologation be reduced and the understanding of the consumers be improved. That was declared by the chairman of ACEA, Bengt Otterhom, and he added that it is also a guideline towards creating of only several world specifications which should replace a larger number of local or regional specifications.[2]

In practice, this new specification defines the minimum requirements for performances of engine oil for 4-stroke heavy-duty high-speed Diesel engines. It is intended primarily for Japanese OEMs in cases when the "genuine oil" cannot be used or when the Japanese JASO DH-1 specification is not recommended. The shortcoming of this new specification is that it does not include all the requests which are contained in the well-known API CH-4. JASO DH-1 or ACEA E5 specifications.

MAIN REQUIREMENTS FOR ATF OILS

Development trends of ATF oils in the last ten years are the consequence of the speeded up development of new designs of automatic gearboxes made by European OEMs, such as, primarily, ZF and VOITH[4]. As the result of that development, the following new requirements for modern ATF liquids are particularly pointed out:

- prolonged oil change interval (from 120,000 to 150,000 km)
- better oxidation stability
- better detersive properties
- better rheologic oil properties – particularly shear stability, lower viscosity, higher IV
- capability of preventing gearbox vibrations – "shudder"
- better capability of shifting gears of the gearbox – ¨shiftability¨

- improved cold start – better oil pumping at low temperatures
- in modern formulations of ATF liquids, the use of PAO is recommended, and the use of ester and hydrocracked base oils is not allowed

Table 7: Estimate of ATF consumption for Croatian market by quality level for the period 1998-2000 (%)

Class	Razina kvalitete	1998.	1999.	2000.
I top-tier oil synthetic, semi-synthetic	DEXRON® III VOITH G 1363 ZF TE-ML 02F, 09A, 14 B i C MAN 339 Type F MB 236.1, 236.8, 236.81 i 236.9	0	0	do 1.5
II high quality mineral base	DEXRON® IiD VOITH G 607 ZF TE-ML 03D, 04D, 09B, 11A i 14D MAN 339 Type D MB 236.6	19.3	20	20-30
III lower quality	GM Type A Suffix A	80.7	80	60-70

From Table 7, it is evident that during the year 2000, the first, however minimum, consumption of ATF liquid of the top level quality occurred. However, the biggest share of the consumption still goes for ATF liquids of the lowest level quality which meets the GM Type A Suffix A specification. The consumption of the standard middle level quality (DEXRON II) is slowly increasing.

AUTOMOTIVE GEAR OILS

New requirements regarding the quality of gear oils have recently been presented through the specifications of the renowned manufacturers of gear systems and vehicles primarily in Europe. It can be said that a sudden change of the quality through specifications of European OEMs has been noticed in the last few years as the result of the demands for fuel efficiency, the change of designs and the introduction of new materials (synchronizers) with expressed requirements for the prolonged oil change interval and a greater use of lubricants for the whole estimated vehicle service life[4]. Almost all the European OEMs recommend in new formulations an increased use of

PAO and the approved new technology of additives. All explicitly agree that the use of hydrocracked or ester base oils is not recommended in new modern formulations.

Estimate for the subsequent period in the field of gear oils

An expected big increase of the testing costs, the approval costs and the general high costs for the development of gear oils will result in the reduction of the number of additives and lubricants producing companies which will be able to keep up with the ever stricter requirements of the automotive industry. However, in the majority of the European countries, which means in Croatia and the wider region, where there is still a relatively old vehicle pool, mineral based gear oils will dominate in the market in relation to higher quality levels for at least 10 succesive years.

Table 8: Estimate of gear oil consumption for differential and final drive in the Croatian market by quality level for the period 1998-2000 (%)

Class	Quality Level	1998.	1999.	2000.
I top-tier oils synthetic, semi-synthetic SAE 75W	MB 235.8 i 235.9 MAN 342 Type TL i SL ZF TE-ML 05 A i B, 12 A i B (prolonged oil change period)	0	0	<1
II high quality prolonged oil change period SAE 80W, 90, 80W-90, 85W-140	MB 235.0 MAN 342 Type N ZF TE-ML 05A, 07A, 12A Supersedes API GL-5	do 5	5-10	15-20
III fighting grade SAE 80W, 90, 80W-90, 85W-140	API GL-5	95	90-95	80-85

Namely, the estimate is that the consumption of synthetic or semi-synthetic gear oils will not exceed 5% of the market share in Croatia and the wider region in 5 years. That is evident from Table 8 on the example of the estimate of the consumption of gear oils only as gear oils for the differential and the final drive (rear axle) unit for the last 3 years.

BRAKE FLUIDS

The leading vehicle and brake system manufacturers pioneer the dramatic development of modern designs of braking systems. For all of them, the goal

is the improvement of driving safety as the basis of their marketing strategy for the purpose of gaining the trust of final users – buyers of new vehicles. In that, with respect to a major development of brake systems, the lead is taken primarily by European vehicle manufacturers, such as BMW, Opel and VW[4]. Highly sophisticated electronics systems for brake systems, the ABS system or the more recent ASR system only put new stricter and sometimes diametrically opposing requirements on the producers of modern brake fluids. Those are the requests for low viscosity, particularly in case of vehicles which have the ASR systems, and the general request for saving of energy.

Table 9: Comparison of specifications and main requirements for brake fluids

CHARACTERISTICS	SAE J1703	ISO 4925	FMVSS 116		
			DOT 3	DOT 4	DOT 5
Boiling point, ^{0}C, minimum	205	205	205	230	260
Wet boiling point, ^{0}C, minimum	140	140	140	155	180
Kinematic viscosity at -40 ^{0}C, mm^2/s, maximum	1800	1500	1500	1800	900

Table 10: Review of new European OEM requirements for brake fluids

European OEM Specification	Remark- Requirements
VW DOT 501.1	VW will apply the top quality levels for all cars by the end of the year Without issuing of approvals
OPEL, BMW	Wet boiling point minimum, 170 ^{0}C Dry boiling point minimum, 265 ^{0}C KV (-40 ^{0}C) = maximum 800 mm^2/s
MB	Improved DOT 4 + requirements Wet boiling point minimum, 180 ^{0}C Rebrand approval can be obtained
VOLVO	Improved DOT 4 + requirements Wet boiling point minimum, 200 ^{0}C Dry boiling point minimum, 300 ^{0}C KV (-40 ^{0}C) = maximum 1400 mm^2/s

However, the most important fact which will have a long-time effect on the brake fluids market is in a way a common decision of all the vehicle manufacturers to use as the first and service fills both, one of the highest

approved qualities. Besides, that recommendation will be valid for all of the types of their vehicles being serviced.

VEHICLE ENGINE COOLANTS[4]

On the market of heat transfer fluids which are used in engine cooling systems, there has been a certain disparateness between various directions of the development for quite some time, which is evident through the comparison of various requirements of numberless OEM specifications. However, we can still say that there is a certain similarity in various approaches, characteristics, and even guidelines of the development between the Japanese OEM on one side, the American ones on the other side, and, what is most important to us, the European OEM on the third side.

It can be said that in Europe, regarding the type of the engine coolants of vehicle engines, in factories and service shops, filling with the so-called nitrite-free-antifreeze prevails, i.e. antifreeze which does not contain the nitrite compounds in the package of corrosion inhibitors along with the obligatory MEG. Such a quality is recommended by approx. 80% of European OEM, and in Germany by almost 100%. It should be pointed out that the exceptions in Europe are French producers PSA and Renault which also recommend special nitrite-free formulations based on MEG. However, the allowed inhibitor packages in case of French OEM are considerably different from those which are used in the nitrite-free formulations of antifreeze, such as, in vehicles of German OEM, and are not compatible with them at all. What is new and what has become a problem with the majority of European OEM is the trend of a greater use of the so-called silicate-free formulations, i.e. antifreeze based on MEG and the corrosion inhibitor package which do not contain silicate compounds. These new formulations were approved by most of the renowned, not only European, OEMs, but, what is important to point out, also for the same vehicle cooling systems as nitrite-free formulations.

Although there are different attitudes, the issue of the compatibility of nitrite-free and silicate-free formulations still has not been completely cleared yet, and the best evidence of that is the request and the recommendation by VW that, in case of the application of one of its two specifications G11 (nitrate-free) and G12 (silicate-free), mutual mixing is explicitly forbidden.

The stated silicate-free formulations are currently most used in Northern America, based on the recommendations of American OEMs (e.g. Ford and

the American part of Daimler-Chrysler). On the other side, another specific quality of this market lies in the fact that some manufacturers of heavy-duty engines/vehicles, such as American Caterpillar, will use rather outdated formulations with a relatively high content of nitrite, but with a smaller content of silicate compounds in approved packages of corrosion inhibitors.

As for the prolonged oil change interval, most OEMs declare 3-5 years as the minimum time of use in case of using the nitrite-free formulation, and 5 years for the silicate-free one. It should be mentioned that, already for a longer period of time, the taboo-theme has been the development of antifreeze formulations for-life, i.e. the possibility of the prolongation of the life time of antifreeze in the vehicle engine system to, for example, 15 years. A great resistance to this kind of the development is given by very influential servicing organizations, particularly in Germany, which do not find their interest in an uncontrolled development, not only of cooling system liquids, but also of lubricants and similar products for-life.

MAIN REQUIREMENTS FOR INDUSTRIAL OILS IN CROATIA

Regarding industrial oils, the demand for a bigger productivity has been present for quite some time already, manifested as requirements for prolonged oil change intervals in industrial systems, the reduction of the equipment standstills and the generally prevailing requirement for the reduction of overall maintenance expenses. Also, biodegradable lubricants and lubricants which are less threatening to the environment are more and more used only in the countries of developed Europe.

As for Croatia, a certain beginning of the industrial renewal has been noticed. The estimate is that the growth rate of industry in Croatia is averagely 2.9%, at least as far as 9 main industrial branches are in question, in which lubricants are used somewhat more than in others. The slow growth of production is based on the appearance of new companies or the change of the ownership structure which then results in the introduction of new machines, which also means the appearance of new specifications and requirements for performance characteristics.

On the example of the metal processing industry in Croatia, new trends regarding the requirements regarding the quality which are otherwise specific for similar markets – regions of transition countries can be presented in greater detail. In the metal processing industry, the following main requirements for working fluids (MWF) prevail. Those are:

- improvement of performance characteristics
- higher speeds of processing and speeds of MWF supply
- requirement for the reduction of the consumption of MWF
- organization of the whole system of non-harmful elimination of used and waste lubricants (collecting, selective separation, change of status – laboratory analysis, repeated processing and finally non-harmful controlled disposal)

This last requirement is valid generally for other types of industrial lubricants as well. However, the fact that makes the situation difficult is that the Croatian metal processing industry is in a very difficult state. Financial problems are big, and, by that alone, the quality of MWF is in the second plan. The management does not give much thought to the application of modern and sometimes more expensive products (per kg) in the light of the need for the reduction of overall maintenance expenses.

LUBRICATING GREASES

Trends regarding the new quality levels, new quality requirements, new specifications and methods of testing are, as always, primarily the result of appearance of the new design of the systems in which greases are used. On the example of bearings for industry and vehicles, a big improvement was noticed through the appearance of new materials and designs of bearing races and tapered roller bearings which resulted in new requirements in the application. FAG[4] from Germany has a particular lead in the development of new designs of bearings for the needs of passenger and commercial vehicles and in the railway transport. New tests for examination of performance and, in particular, of high-temperature qualities of greases, such as the FAG FE8 and FAG tests, mean the new rules of the game too. New greases cannot be developed, homologated, which means, sold in the market without carrying out of the stated tests. That is only one example of the increase of testing costs (both tests for a single grease cost at least DEM 25,000). Furthermore, the leading designers of systems, e.g. bearings, recommend that completely synthetic or partially synthetic greases be used for new designs. However, the emphasis lies on the fact that the use of ester and hydrocracked base oils is forbidden, and the priority is given to base oils of the group IV, i.e. PAO.

The good news is that the vacuum due to the shortage of the official classification and the possibilities of registration of the so-called "food-grade" greases, will perhaps finally be filled in. Namely, the working group ELGI / NLGI/EHEDG endeavours to create the system of classification and registration

of the "food-grade" greases as the replacement for USDA H1/H2 1999[5] - Procedural Requirement for the Registration of FGL 1/2000 Issue 1. Besides, the draft of the DIN V 01517[6] standard was approved by the German committee for the food hygiene in April 2001.

SURVEY OF BASE OIL PRODUCTION TRENDS[7,8]

Due to diverse reasons, and primarily due to the unexpected change and the rationalization of the lubricants program per particular markets of developed Europe (but also of the world) and the interest of the big oil companies, owners of new technologies (group II and III), a change in the structure of the consumption of base oils in developed Europe will occur until 2005. This trend regarding the increase of the consumption of group III in the world is based on and will be conditioned by the following:

- the increased use of formulations according to the GF-3 specification, of the SAE 5W-30 grade
- the need for the replacement of PAO (the price, competitiveness, possessing of the technology for base oil groups II, II+ and III)
- specific requirements of European OEMs
- the interest of the limited number of producers and owners of the technology of the 1st and 2nd generation (groups II and III)
- the existing limitation for group III.

What can be forecast is that a high price supported by the quality will be accepted in future. In developed Europe, and particularly in European transition countries, there will be a considerably smaller increase of the consumption of oils from groups II and III.

But while the priority is given to the use of PAO in the markets of developed Europe under the influence of OEM and the appearance of new modern vehicles and the industrial equipment, in European transition countries, the consumption of base oils from groups II and III will also be somewhat smaller, not only due to the high price of base oils, but also due to the high structure of the market and the requirements regarding the quality. On the basis of the existing data[7], it can be stated that only 10% of European refineries can meet the requirements regarding the quality and the base oils assortment until the year 2005, which will have a far-reaching consequence on the operation of oil companies. Furthermore, it can be expected that the price of base oils will be changed in accordance with the change of crude oil prices.

From Table 11, it is evident that an increased production and supply of the so-called non-conventional mineral oils will occur in the next period, primarily of those from groups II, II+ and III, the price of which will in the beginning be less than the realistic one, due to the big supply.

Table 11: Change of base oil consumption in Europe until 2005

Group	Base oil type	Consumption	Capacities
I	Mineral base oils	Decrease up to 3% (like in the world)	Decrease up to 80%
II	Unconventional mineral base oil	Increase from 4 to 5.5%	Increase up to 16%
III	Unconventional mineral base oil with high I.V. (>120)	Increase from 9 to 16%	Increase up to 6%

Impact of world trends on market conditions in the region[9]

Because of the dramatic increase of the testing costs, the development of new designs, new requirements about quality, the most prominent of which is the requirement about the prolongation of the period for (change) duration of oil, a decrease in the consumption of lubricants at the world level is expected after 2002, at the rate of 1-2%. Furthermore, the relationships on the relation OEMs – lubricants producers – additives producers – servicing organizations will be more and more tough. Accordingly, an increase in the sale of "original oils" under OEM names (Ford, GM, Daimler-Chrysler, VW) is expected to occur in some developed and less developed markets, by which vehicle manufacturers enter the lubricant business and start changing the existing relationships.

All that will also have an effect on the intensified trend of increased deliveries of the so-called "Premium global - branded products" from other regions, thus, locations of the "big ones", while the production of lower quality lubricants or "Low-quality products - Fighting grade" will be concentrated in the region.

By the very change of business conditions, globalization or also due to the specific characteristics of particular markets, there will be an increase, i.e. appearance of new companies of nominal producers of lubricants, even up to 2%. However, unlike before, only those new companies which have **all** the essential, i.e. primary activities within the company will dominate and survive. Those primary activities are, beside sale, the application-technical service, the

application development and the production-blending. Thus, the influence (problem) of excessive production capacities will be more and more present. That will result in the limitation of investments, which will then create a pressure on the existing technological capabilities.

Since lubricants are an activity defined as a "service industry", the imperative of the effectiveness of operation, which will be set before the managements of "old", but also of new companies, will be the obligation to reduce overall production expenses (the total product cost).

The next important trend or, to put it better, statement is the appraisal of the management which necessarily effects the strategy of operation. The days of the struggle for brand names are gone. Namely, all the serious companies – lubricant producers invest enormous assets in promotion, homologations, expensive practical and laboratory testing, etc.

The dominance, improvement of the position or keeping of leadership in a market is today primarily the issue of the best logistics[10], and not of the best promotion. Today, the majority of large companies reexamine their enormous expenses of investing in new markets through promotion of top brands, because the capital invested has not been returned through the sale of top-tier products.

The need for a better and more expert organization of logistics will arise, with the emphasis on the need for the realization of various integrations with the obligation of bringing the supply channels to a higher level of connection, production, sale and final users.

Today it is more than evident that the key for the survival of smaller or larger companies lies in the flexibility of production with an emphasis on solving of bottlenecks – with the smallest possible expenses and the biggest possible speed of adjustment. There will be a division of the existing companies, i.e. companies producers of lubricants to:

1. companies with all the necessary activities which will have to consider the operation and the organization of the operation seriously, with the need of rationalization in the operation - "striking a balance".
2. smaller regional companies which will be forced to a "marriage with the stronger ones", with an uncertain and difficult struggle for the survival.

CONCLUSIVE REMARKS:

1. Production of lubricants is still one of the most profitable businesses in oil industry.

2. Regarding the assortment and the quality of lubricants and similar products, the Croatian market follows the trends of European market.

3. The offer is dominated by mineral based lubricants of lower and/or middle quality level (60-90%).

4. Consumption of the top-tier, mostly synthetic and semi-synthetic lubricants are at the moment, and will be for the next period, from 1 to 5% of the total consumption, depending on the type of lubricants.

5. In the next period, the rationalization of the program of lubricants and the quicker adjustment to market demands will occur.

6. In the formulations of top-tier lubricants, PAO will be used more, while the use of hydrocracked base oils will be limited mostly to higher-quality engine oils, and, in case of industrial oils, mostly to higher-quality turbine oils.

7. Large global companies – producers of lubricants have completed the phase of "first conquering" of secondary markets, along with imposing of their well-known global brand. They learned the lesson, i.e. they are not satisfied with the profit realized from sales of the premium or top-tier quality in relation to the invested assets.

8. In the next ten years, the struggle for the most favourable sales logistics will be present on the market of the Republic of Croatia, but regional companies will have to keep on building a recognizable, original and acceptable brand of lubricants.

9. The flexibility, the on-time delivery and, in general, fast responses to market demands are the key for the survival of smaller, but also of larger regional companies.

Literatura / References:

1. Službeni podaci MUP-a RH, Hrvatska za razdoblje 1996-2000.
2. Heavy-Duty Diesel Engine Oil Guidelines Announced, ACEA Press Release, Brusseles, 19. april 2001.
3. Global DHD-1, Recommended Guideline
4. Tehnička dokumentacija europskih konstruktora i proizvođača vozila (OEM)
5. Procedural Requirement for the Registration of FGL 1/2000, Issue 1
6. Nacrt norme DIN V 01517
7. THE FIFTH ICIS-LOR World Base Oil Conference, February 2001, London
8. ILMA Coumplings, February 2001,14
9. "Industrija maziva", (prijevod i osvrt na članak S. Jagger), *Goriva i maziva*, 5, 2000, 331.
10. "Lubricants Supplay Chain Vision Can maximize Competetive Advantage", John Juzswik, Ali Raza, *Lubricants World*, February 2001.

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