В большинстве случаев такое застревание приводит к необходимости замены верхней крышки бустера вместе с застрявшим плунжером. Но надо отметить, что эта операция на интеллектуальных двигателях гораздо менее трудоемкая, по сравнению с аналогичной операцией на конвенционных дизелях.

Одним из возможных методов немедленного ремонта при застревании может служить прямое воздействие на плунжер. Для этого предлагается использование латунного прута и кувалды. Латунный прут устанавливается прямо на плунжер через технологическое отверстие, которое в нормальном состоянии закрыто заглушкой (рисунок 2, позиция 5) с левосторонней резьбой. После установки прута по нему наносится короткий и сильный удар. В случае если застревание плунжера не было критически сильным, то он уйдет в нижнее положение. Естественно, что перед началом подобной операции необходимо закрыть подачу топлива и гидравлического масла. Гидравлическое масло должно быть дренировано силового блока топливного бустера. Если указанный метод не помог, то необходима замена верхней крышки.

Для предотвращения отвинчивания дросселя неплохо показало себя затягивание дросселя на соответствующий размеру момент затяжки (для двигателя 6S50ME-GI размер резьбы M10x1,5 и момент 50Нм) с использованием фиксатора резьбы средней силы Loctite 222. После 3000 часов эксплуатации после ремонта дроссель находился в плотно затянутом состоянии и отказов на данной цилиндре не наблюдалось. В принципе, как и на всем двигателе с примененными привентивными мерами.

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DOI: 10.34046/aumsuomt100/20

ОСОБЕННОСТИ ИСПОЛЬЗОВАНИЯ ЭЛЕКТРОННОГО ИНДИКАТОРА LEUTERT «DPI50 MIP CALCULATOR» ДЛЯ СУДОВЫХ ДИЗЕЛЬ–ГЕНЕРАТОРОВ И ДИЗЕЛЬ–ГЕНЕРАТОРОВ БЕРЕГОВЫХ ЭЛЕКТРОСТАНЦИЙ

А.Г. Таранин, кандидат технических наук

Настоящая публикация освещает следующие вопросы: правильное использование электронного индикатора при индицировании четырёхтактных двигателей внутреннего сгорания (ДВС); правильный перенос индикаторных диаграмм и результатов индицирования на ПК; корректировка верхней мёртвой точки ВМТ индикаторной диаграммы и корректный расчёт выходных значений характеристик двигателя, таких как PMI – средне–индикаторное давление, PME – средне–эффективное давление, NIND – индикаторная мощность и NEFF – эффективная мощность для каждого цилиндра и двигателя в целом.
Keywords: Engine indication, performance data, electronic indicator, mean–indicated pressure, mean–effective pressure, indicated power, effective power.

USAGE FEATURES OF THE LEUTERT «DPI50 MIP CALCULATOR» FOR SHIP'S AND SHORE POWER SUPPLY DIESEL GENERATORS

A.G.Taranin

The present publication illuminate the tasks as follows: Electronic indicator proper usage at four–stroke internal combustion engines (diesel engines) indication; Indication results & diagram proper transfer to PC; indicator diagram top dead center TDC correction and engine performance data output values such as PMI–mean indicated pressure, PME–mean effective pressure, NIND–indicated power and NEFF–effective power proper calculations for each cylinder and engine total.

Keywords: Engine indication, performance data, electronic indicator, mean–indicated pressure, mean–effective pressure, indicated power, effective power.

Introduction

Currently on the worldwide fleet motor–vessels and shore diesel power plants for internal combustion engines–diesel engines indication and performance data measurement readings carrying–out the micro–processing gauging and systems such as Doctor–Engine, Diesel–Doctor and Electronic indicators (different kind of brands and manufacturers) are used in most of cases. However, actually they are not carrying–out the functions of the engines technical condition (cylinder tightness, fuel injection equipment condition and turbocharger system condition) diagnostic and analysis, overload/download analysis and load distribution between the cylinders analysis, but they are electronic gauges for compression pressures P_{COM}, maximum combustion pressures P_{MAX} measurement by open indicator diagrams (Fig.2) and closed indicator diagrams (Fig.3) for each cylinder and for engine speed measurement at each cylinder indication. All others values are required for the engine technical condition diagnostic and analysis has determined by calculation from indicator diagrams or entered manually to the electronic equipment tables.

Examine the engine indication results from **LEUTERT «DPI50 MIP CALCULATOR» (GMBH, Germany)**:

1) The values are measured by MIP calculator (Figure 4):

- Cylinders maximum combustion pressure (bar) (Figure 4);
- Cylinders pressure at TDC (compression pressure) (bar) (Figure 4);
- Engine speed (rpm) (Figure 4);

2) The values are calculated from the indicator diagrams:

- Cylinders indicator diagrams area A_D (mm^2);
- Cylinders mean–indicated pressure P_{MI}^{CYL} (bar) – by MIP calculator (Figure 4);
- Cylinders mean–effective pressure P_{ME}^{CYL} (bar);
- Cylinders indicated power N_{IND}^{CYL} (IKW) – by MIP calculator (Figure 4);
- Cylinders effective power N_{EFF}^{CYL} (EKW);
- Engine average mean–indicated pressure P_{MI}^{ENG} (bar) – by MIP calculator (Fig.4);
- Engine average mean–effective pressure P_{ME}^{ENG} (bar);
- Engine indicated power N_{IND}^{ENG} (IKW) – by MIP calculator (Figure 4);
- Engine effective power N_{EFF}^{ENG} (EKW);
- Engine mechanical efficiency η_{MEC} (%).

3) The values are entered manually to the electronic equipment tables (Figure 4):

- Scavenging air pressure after scavenging air cooler P_{SC}^{AC} (bar);
- Cylinders exhaust gas temperatures T_{EXH}^{CYL} (^{O}C);
- Cylinders fuel rack position FRP (fuel pump index FPI) (mm);

Note: However, the mentioned above values are not enough for the engine technical condition full diagnostic and analysis (cylinder tightness, fuel injection equipment condition and turbocharger system condition).

In completion of indication data entering to the PC without TDC correction the engine average mean–indicated pressure & indicated power calculation can give tolerance up to $\pm$12.5%, while the same values calculation from indicator diagrams are taken by mechanical indicator with usage of computerized technology gives tolerance up to $\pm$0.5% only.

The engine average mean–indicated pressure and indicated power calculation tolerance up to $\pm$12.5% is not satisfactory for the engine technical condition (cylinder tightness, fuel injection equipment condition and turbocharger system condition) diagnostic and analysis, overload/download analysis and load distribution between the cylinders analysis.

Thereby we suggest the engine (4–stroke engine) indicated power accurate calculation procedure, afterwards it is possible a TDC accurate correction for each cylinder, and then a cylinders mean–indicated pressure P_{MI}^{CYL}, cylinders indicated power N_{IND}^{CYL} & engine average mean–indicated pressure P_{MI}^{ENG} same accurate calculation within tolerance $\pm$0.5%.

Work object

The high accuracy obtaining in the indicator diagram treatment and as results high accuracy in the cylinder power calculation, determination of load distribution between cylinders and cylinders/engine condition diagnostic & analysis without engine dismantling.

Ways of investigation

Investigations has carried out on the vessel's and shore engines (with effective power from **300 EKW** up to **6600 EKW**) with different kind of micro–processing gauging and systems (Doctor–Engine, Diesel–Doctor and Electronic indicator) & with mechanical indicators.

Investigation results and discussion about

1. LEUTERT «DPI50 MIP CALCULATOR» (GMBH, Germany) introduction:

1) In previous publication «USAGE FEATURES OF THE ELECTRONIC INDICATORS FOR SHIP'S AND SHORE POWER SUPPLY FOUR–STROKE INTERNAL COMBUSTION ENGINES (DIESEL ENGINES) we have introduced the **«HLV–2005 MK» MIP Calculator** (Praezisionsmesstechnik Beawert GMBH, Germany) (Picture 1), which has the cylinders TDC correction tolerance within 0.5^{O} CA.

2) Presently we introduce the **«LEUTERT DPI50» MIP Calculator** (GMBH, Germany) with the cylinders TDC correction tolerance within 12.5^{O} CA (Picture 1).

2. Diesel Engine Indicator & Effective power dependence of alternator total, but not active load.

1) Relationship between the alternator active load, reactive load, total load and cosφ (Figure 1):

$$P = \frac{\sqrt{m}\cdot V\cdot A\cdot \cos\varphi}{1000}\ (KW);\qquad Q = P\cdot tg(\varphi)\ (KVAr);$$

$$S = \frac{\sqrt{m}\cdot V\cdot A}{1000} = \sqrt{P^2+Q^2}\ (KVA);$$

Where: m – NOs of phases;
V – alternator voltage;
A – alternator current;
φ – angel between active load and total load;
P – active load;
Q – reactive load;
S – total load.

«HLV–2005 MK» MIP CALCULATOR
TDC correction tolerance is 0.5^{O} CA
Two sensor connections.
1. One pressure sensor with pressure transmitter, connected to the indicator cock.
2. One RPM peak–up sensor, connected to the flywheel frame

«LEUTERT DPI50 MIP» CALCULATOR
TDC correction tolerance is 12.5^{O} CA
One sensor connections.
1. One pressure sensor with pressure transmitter, connected to the indicator cock.

Picture 1

2) Total load changing at the constant active load and changing reactive load (figure 1):
For example: P = constant;
Q = ↑ (has increased by ΔQ due to alternator excessive temperature or rotor–stator center line misalignment);
Therefore: $S = \sqrt{P^2+Q^2}$ ↑ (has increased by ΔS from the formula and figure 2);

$\varphi = \mathrm{arctg}\left(\frac{Q}{P}\right)\uparrow$ (has increased by $\Delta\varphi$ from the formula and figure 2);

$\cos\varphi = \downarrow$ (has decreased by $\Delta\cos\varphi$);

As: $P = \text{constant}$ and $\frac{\sqrt{m}\cdot V}{1000} = \text{constant} \Rightarrow$

Therefore: $A\cdot\cos\varphi = \text{constant}$;

If: $A\cdot\cos\varphi = \text{constant}$ and $\cos\varphi = \downarrow \Rightarrow$

Threfore: $A = \uparrow$ (has incresed by ΔA);

If: $S = \uparrow \Rightarrow$

Threfore: $N_{IND} = \uparrow$ and $N_{EFF} = \uparrow$ (even at P = constant; see figure 3);

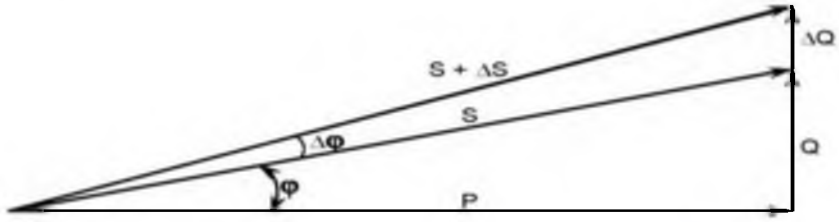


Figure 1

3) Diesel Generators Nos.1,2&3 (HYUNDAI MAN–B&W6L23/30) performance data samples of total load changing at the constant active load and reactive load changing (table 1):

Table 1

	G/E No:	1	2	3
FUEL PUMP INDEX	mm	20,1	20,2	20,4
COSINUS PHY	(-)	0,6739	0,6773	0,6678
FREQUENCY	Hz	60,0	60,0	60,0
CURRENT	A	1126,7	1122,5	1135,8
VOLTAGE	V	434,8	435,0	435,0
ACTIVE POWER	KW	571,8	572,8	571,5
TOTAL LOAD	KVA	848,5	845,7	855,8
TURBOCH.SPEED	RPM	44250	44070	44940
MAX.COMBUSTION	mm			
PRESSURE	BAR	110,5	111,2	111,8
COMPRESSION	mm			
PRESSURE	BAR	99,3	102,1	101,7
SCAV. AIR PRESS.	BAR	1,554	1,5196	1,6004
MIP	BAR	17,4	17,4	17,6
INDICATED POWER	IKW	124,7	124,3	125,7
		124,7	124,3	125,7
			621,4	628,4
MEAN EFFECTIVE PRESSURE	BAR	16,4	16,4	16,6
EFFECTIVE POWER	EKW	117,5	117,1	118,5
MASS - Gfo	kg / hr	147,756	152,651	178,314

3. The indicator diagrams TDC correction and each cylinder/total engine output data calculation after the 4–stroke Diesel Generator DAIHATSU type 5DK20 indication by «LEUTERT DPI50» MIP CALCULATOR.

1) The Diesel Generator performance data some measurement readings are taken at each cylinder indication and its average values calculation (table 2):

Table 2

CYLINDER NO		1	2	3	4	5		
EG TEMPERATURE	°C	380	362	360	366	378		369,2
FUEL PUMP INDEX	mm	19,5	17	17,5	19	22		19
COSINUS PHY	(-)	0,807	0,791	0,805	0,774	0,773		0,79
FREQUENCY	Hz	59,86	59,87	59,86	59,82	59,86		59,9
CURRENT	A	526,17	532,10	542,43	542,37	524,57	AVERAG	533,5
VOLTAGE	V	446,8	446,8	446,7	446,93	447,07		446,9
ACTIVE POWER	KW	329,7	341,2	336,2	331,1	311		329,8
REACTIVE POWER	KVAR	254,1	254,8	255,6	257,1	254,6		255,2
TOTAL LOAD	KVA	411,8	424,8	421,9	419,4	401,9		416,0

2) The generator calculated active, reactive and total loads by the average values of voltage V, amperage A and power factor cosφ measurement readings at each cylinder indication from table 2:

$$P = \frac{\sqrt{m} \cdot V \cdot A \cdot \cos\varphi}{1000} = \frac{\sqrt{3} \cdot 446.9 \cdot 533.5 \cdot 0.79}{1000} = 326.22 \text{ KW};$$

$$Q = P \cdot tg(\arccos\varphi) = 326.22 \cdot tg(\arccos 0.79) = 253.17 \text{ (KVAr)};$$

$$S = \frac{\sqrt{m} \cdot V \cdot A}{1000} = \frac{\sqrt{3} \cdot 446.9 \cdot 533.5}{1000} = 412.94 \text{ KVA};$$

$$S = \sqrt{P^2 + Q^2} = \sqrt{326.22^2 + 253.17^2} = 412.94 \text{ KVA};$$

3) The generator measured active, reactive and total loads by the kilo–wattmeter, kilo–VArmeter and kilo–VAmeter accordingly at each cylinder indication from the table 2:

$P = 329.8$ KW; $Q = 255.2$ KVAr; $S = 416$ KVA;

4) The Diesel Generator measurement readings data are taken from the shop trial test results (table 3):

Table 3

Description	Symbol	Meas. unit	Value selection or Source or calculation	Calculated values				
			DG Main Variables					
Generator speed	n	RPM	by observation	720	720	720	720	720
Alternator NOs of pole pairs	p	-	from DG technical data	5	5	5	5	5
Alternator frequency	F	Hz	by observation	60	60	60	60	60
Alternator frequency	F	Hz	$F = n \cdot p / 60$	60	60	60	60	60
Alternator current	I	A	by observation	168.4	336.8	505.1	673.5	740.9
Alternator voltage	U	V	by observation	450	450	450	450	450
Alternator NOs of phases	m	-	from DG technical data	3	3	3	3	3
Alternator power factor	cosφ	-	$\cos\varphi = P / S$	0.8	0.8	0.8	0.8	0.8
Alternator active load	P	KW	by observation	105	210	315	420	462
Alternator active load	P	KW	$P = m^{0,5} \cdot U \cdot I \cdot \cos\varphi / 10^3$	105	210	315	420	462
Alternator reactive load	Q	KVAr	$Q = P \cdot tg\varphi$	78.7	157.5	236.2	314.9	346.4
Alternator total load	S	KVA	$S = P / \cos\varphi$	131.2	262.5	393.7	524.9	577.4
Alternator total load	S	KVA	$S = (P^2 + Q^2)^{0,5}$	131.2	262.5	393.7	524.9	577.4
Engine effective power	N_{EFF}	EKW	by observation	114	228	342	456	501.6
Engine indicated power	N_{IND}	IKW	by observation	142.3	256.3	370.3	484.3	529.9
Engine mechanical loss	N_{MEC}	KW	$N_{MEC} = N_{IND} - N_{EFF}$	28.3	28.3	28.3	28.3	28.3
Alternator total load factor	η_{GU}	-	$\eta_{GU} = N_{IND} / S$	1.0843	0.9765	0.9405	0.9226	0.9177
Engine indicated power	N_{IND}	IKW	by diagram	142.3	256.3	370.3	484.3	529.9

5) Draw the diagrams of alternator total load factor and engine indicated power dependence of total load from shop trial test results table and found it dependence functions by the trend lines (Diagrams 1 & 2):

Diagram 1

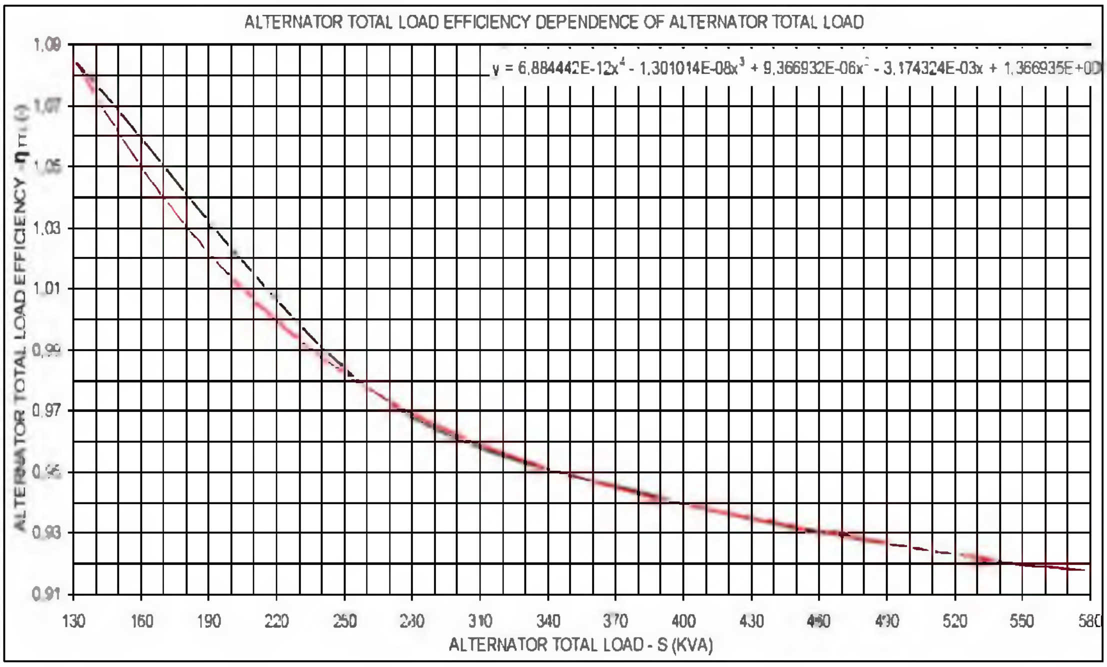


Diagram 2

6) The alternator calculated total load factor by the function is founded from the diagram 1:

$$\eta_{TTL} = 6.884442 \cdot 10^{-12} \cdot S^4 - 1.301014 \cdot 10^{-8} \cdot S^3 + 9.366932 \cdot 10^{-6} \cdot S^2 - 3.174324 \cdot 10^{-3} \cdot S + 1.366935 = 6.884442 \cdot 10^{-12} \cdot 412.94^4 - 1.301014 \cdot 10^{-8} \cdot 412.94^3 + 9.366932 \cdot 10^{-6} \cdot 412.94^2 - 3.174324 \cdot 10^{-3} \cdot 412.94 + 1.366935 = 0.93745$$

$$\eta_{TTL} = 6.884442 \cdot 10^{-12} \cdot S^4 - 1.301014 \cdot 10^{-8} \cdot S^3 + 9.366932 \cdot 10^{-6} \cdot S^2 - 3.174324 \cdot 10^{-3} \cdot S + 1.366935 = 6.884442 \cdot 10^{-12} \cdot 416^4 - 1.301014 \cdot 10^{-8} \cdot 416^3 + 9.366932 \cdot 10^{-6} \cdot 416^2 - 3.174324 \cdot 10^{-3} \cdot 416 + 1.366935 = 0.93698$$

7) The engine calculated indicated power by the functions are founded from the diagrams 1&2:

$$N_{IND} = 0.8686686 \cdot S + 28.3 = 0.8686686 \cdot 412{,}94 + 28.3 = 387 \text{ IKW}$$

$$N_{IND} = 0.8686686 \cdot S + 28.3 = 0.8686686 \cdot 416 + 28.3 = 389.7 \text{ IKW}$$

$$N_{IND} = S \cdot \eta_{TTL} = 412.94 \cdot 0.93745 = 387.1 \text{ IKW}$$

$$N_{IND} = S \cdot \eta_{ETL} = 416 \cdot 0.93698 = 389.8 \text{ IKW}$$

8) Enter the engine indication and performance data to the PC (Figures 2, 3 & 4):

Conclusion: As we have seen from the figure 2 and figure 3 the engine all cylinders indicator diagrams compression lines are in different position (arrow 1), that is what can not be for the same designed cylinders. They to be in one line that is supposed to be adjusted by the cylinders TDC correction individually **(But in the «LEUTERT DPI50» MIP CALCULATOR attached computerize program this particular correction is possible within tolerance 12.5^{O} that is not acceptable for future analysis)**. As we have seen from the figure 4 the engine indicated power is 487.06 IKW instead of calculated in item (7) – 387.1 IKW, that is become «20.52%» tolerance, which is not acceptable for the engine technical condition diagnostic and analysis. We have to correct the engine cylinders TDC totally.

9) Engine cylinders TDC correction program development.

As it is mentioned above in item (8) that by the «LEUTERT DPI50» MIP CALCULATOR attached computerize program cylinders TDC correction is possible within tolerance 12.5^{O} and that is not acceptable for future analysis, we have to develop the correction program (Figure 5).

10) Engine cylinders TDC correction program development.

As it is mentioned above in item (8) that by the «LEUTERT DPI50» MIP CALCULATOR attached computerize program cylinders TDC correction is possible within tolerance 12.5^{O} and that is not acceptable for future analysis, we have to develop the correction program (Figure 5).

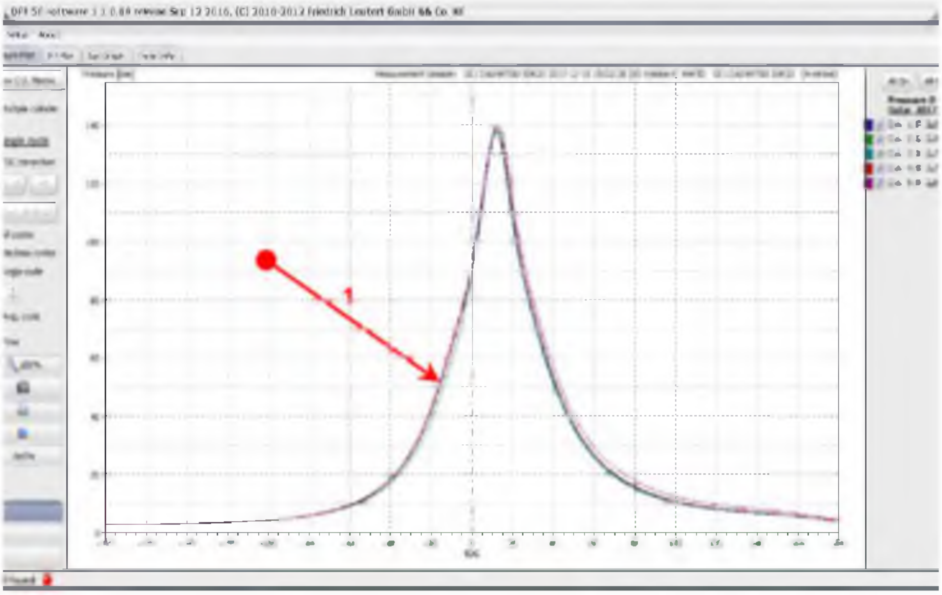


Figure 2 – Cylinders open type indicator diagram before TDC correction

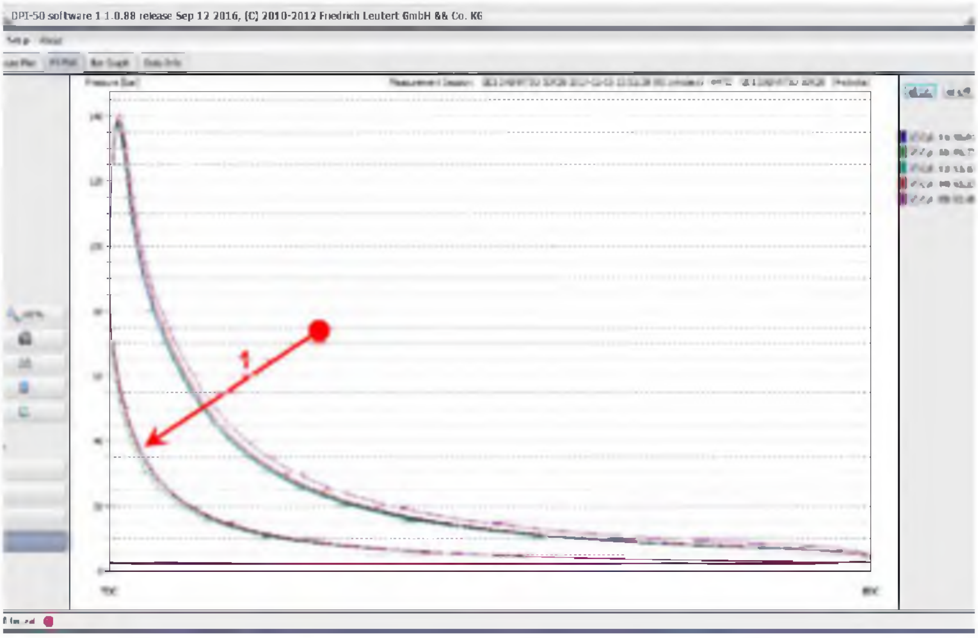


Figure 3 – Cylinders closed type indicator diagram before TDC correction

DPI 50 software 1.1.0.88 release Sep 12 2016, (C) 2010-2012 Friedrich Leutert GmbH && Co. KG

File Setup About

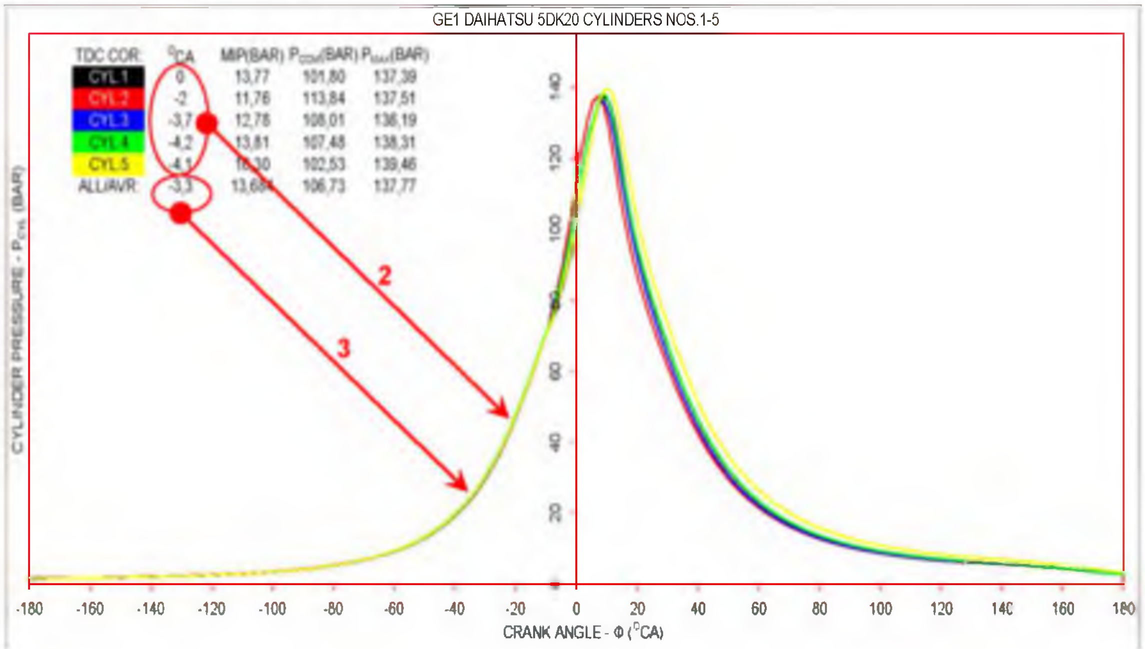
Pressure Plot | PV Plot | Bar Graph | Data Info

Measurement Session: GE1 DAIHATSU 5DK20 2017-12-15 15:52:38 (05 cylinders) HAFID GE1 DAIHATSU 5DK20 (4-stroke)

	Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4	Cyl. 5	Mean	Total
Date	2017-12-14	2017-12-14	2017-12-14	2017-12-14	2017-12-14		
Time	15:21:47	15:22:48	15:24:18	15:25:39	15:26:56		
Average cycles	10	10	10	10	10		
Pmax_av [bar]	138.33	138.45	137.13	139.25	140.40	138.71	—
Pmax_max [bar]	140.02	139.94	138.51	140.03	141.91	140.08	—
Pmax_low [bar]	136.30	137.04	136.61	137.39	139.21	137.31	—
MIP [bar]	16.86	16.87	16.25	17.32	19.02	17.26	—
Deviation [bar]	-0.38	-0.26	-1.58	0.54	1.69	0.00	—
Pldc [bar]	90.04	89.27	93.10	92.53	92.48	91.48	—
RPM [1/min]	718.80	718.79	718.36	717.90	718.56	718.48	—
Ind. power [KW]	95.20	95.22	91.66	97.67	107.31	97.41	487.06
Boost pressure [bar]	2.00	2.00	2.00	2.00	2.00		
Exhaust gas temp. [deg. C]	380	362	360	366	378		
Fuel rack setting	19.50	17.00	17.50	19.00	22.00		
VIT setting	0.00	0.00	0.00	0.00	0.00		
Additional information							

Export to Excel

Figure 4 – Cylinders indication & performance data table before TDC correction



MEAN IND.PRESS.	kg/cm^2	14,04	11,99	13,04	14,08	16,62	AVERAG	14,0
INDICATED POWER	IKW	77,17	79,43	78,93	78,49	75,45		77,9
		77,63	66,32	72,08	77,85	91,91		77,2
INDICATED POWER	IKW		ALTER.TTL LOAD EFFICIENCY			0,9371		
		TOTAL	**385,8**	**386,8**	**387,0**	**390,8**		
MEAN EFF.PRESS.	kg/cm^2	13,02	10,98	12,02	13,06	15,60	AVERAG	12,9
EFFECTIV.POWER	EKW	72,01	60,70	66,46	72,23	86,29		71,5
		TOTAL	**357,68**					

Figure 5 – Cylinders open indicator diagrams after TDC correction by developed program

11) Correct the engine cylinders TDC first of all individually for making the diagrams compression lines in one line (arrow 2), then totally for making the engine indicated power same as calculated in item (7) (arrow 3) (Figure 5):

Cylinder 1 TDC = 0°CA; Cylinder 2 TDC = – 2°CA; Cylinder 3 TDC = – 3.7°CA;

Cylinder 4 TDC = – 4.2°CA; Cylinder 5 TDC = – 4.1°CA; All Cylinders TDC = – 3.3°CA;

Conclusion: As we have seen from the Figure 5 the engine all cylinders indicator diagrams compression lines are in one line after TDC correction (arrow 2), that is what to be for the same designed cylinders. As we have seen from the same figure the engine indicated power is 385.8 IKW and almost the same with calculated in item (7) 387 IKW, that is become «– 0.03%» tolerance, which is perfect for the engine technical condition diagnostic and analyses.

12) The Diesel Generator mechanical loss pressure from performance data (indication) test results:

$$P_{MEC} = 1.036 \text{ kg/cm}^2;$$

13) The Diesel Generator mean–effective pressure calculation:

$$P_{ME} = P_{MI} - P_{MEC} = 14 - 1.036 = 12.96 \text{ kg/cm}^2;$$

where: P_{MI} = 14 kg/cm^2 – from the engine performance data results table (Figure 5);

P_{MEC} = 1.036 kg/cm^2 – from item (11).

14) The Diesel Generator effective power calculation:

$$N_{EFF} = k \cdot P_{ME} \cdot n \cdot i = 0.0078504 \cdot \frac{12.96}{1.0197} \cdot 718.248 \cdot 5 = 358.3 \text{ EKW};$$

where: $k = 1.3084 \cdot D^2 \cdot S \cdot m = 1.3084 \cdot 0.2^2 \cdot 0.3 \cdot 0.5 = 0.0078504$ – cylinder constant;

D = 0.2 mtr – cylinder diameter;

S = 0.3 mtr – piston stroke;

m = 1 – stroke factor (for 4–stroke engine m = 0.5; for 2–stroke engine m = 1).

Conclusion

As we have seen from mentioned above information for Diesel Generators indicator diagrams TDC correction the generator unit (alternator) electric performance data measurement readings to be taken, recorded & output data are effected to the TDC correction to be calculated. For Diesel Propulsion Engines indicator diagrams TDC correction the ME indirect values measurement readings to be taken, recorded & output data are effected to the TDC correction to be calculated.

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ОСОБЕННОСТИ ИСПОЛЬЗОВАНИЯ ЭЛЕКТРОННОГО ИНДИКАТОРА LEUTERT «DPI50 MIP CALCULATOR» ДЛЯ СУДОВЫХ ГЛАВНЫХ ДВИГЕТЕЛЕЙ ВНУТРЕННЕГО СГОРАНИЯ

А.Г. Таранин, кандидат технических наук

Настоящая публикация освещает следующие вопросы: правильное использование электронного индикатора при индицировании двухтактных двигателей внутреннего сгорания (ДВС); правильный перенос индикаторных диаграмм и результатов индицирования на ПК; корректировка верхней мёртвой точки ВМТ индикаторной диаграммы и корректный расчёт выходных значений характеристик двигателя, таких как P_{MI} – средне–индикаторное давление, P_{ME} – средне–эффективное давление, N_{IND} – индикаторная мощность и N_{EFF} – эффективная мощность для каждого цилиндра и двигателя в целом.

USAGE FEATURES OF THE LEUTERT «DPI50 MIP CALCULATOR» FOR SHIP'S PROPULSION DIESEL ENGINES

A.G. Taranin

The present publication illuminate the tasks as follows: Electronic indicator proper usage at two–stroke internal combustion engines (diesel engines) indication; Indication results & diagram proper transfer to PC; indicator diagram top dead center TDC correction and engine performance data output values such as P_{MI}–mean indicated pressure, P_{ME}–mean effective pressure, N_{IND}–indicated power and N_{EFF}–effective power proper calculations for each cylinder and engine total.

Keywords: Engine indication, performance data, electronic indicator, mean–indicated pressure, mean–effective pressure, indicated power, effective power.

Introduction

Currently on the worldwide fleet motor–vessels and shore diesel power plants for internal combustion engines–diesel engines indication and performance data measurement readings carrying–out the micro–processing gauging and systems, such as Doctor–Engine, Diesel–Doctor and Electronic indicators (different kind of brands and manufacturers) are used in most of cases. However, actually they are not carrying–out the functions of the engines technical condition (cylinder tightness, fuel injection equipment condition and turbocharger system condition) diagnostic and analysis, overload/download analysis and load distribution between the cylinders analysis, but