YANMAR SERVICE NEWS

Subject	Rise of Exhaust Gas Temperature	No.: 16-2-G-08-001-O-rev.1 Aug. 2016

Engine Model	6EY18(A)L(W)	Use	Marine Aux. Engines, Industrial
		Engine Nos.	

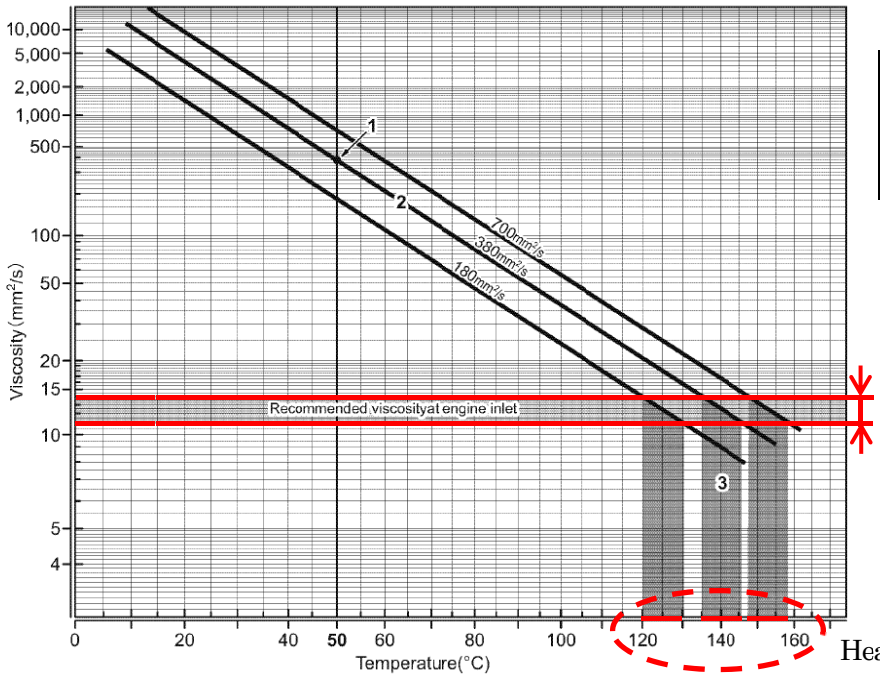
In the 6EY18 engines, The problem that exhaust gas temperature won't be dropped although the turbocharger was disassembled and maintained occurs. The exhaust gas temperature rise is caused by faulty combustion. The major contributing factors for the faulty combustion are (1) inappropriate heating temperature of H.F.O., (2) faulty FO injection and (3) performance drop of turbocharger. In order to solve the problem, implement the corrective measures for each of the contributing factor as described below.

1.Inappropriate Heating Temperature of HFO (Inappropriate Viscosity of HFO)

When operating on HFO, the fuel temperature must be controlled so that the viscosity at the engine inlet becomes to be 11~14cSt. To obtain the appropriate heating temperature, refer to the example shown in the operation manual. When the temperature is obtained, include appropriate temp. allowance for the temp. drop in the piping and adjust the setting of the heater and the viscosity control equipment.

If the engine inlet temperature can't be improved with the adjustment of the setting, it is possible that the balance between the engine inlet pressure, P1, and the return pressure, P2, has collapsed, which has caused the fuel flow volume to the engine to be insufficient, (see Fig.1 below) . In this case, adjust the respective pressure regulating valve to obtain the following pressure:

Pressure Setting of Hull-mount Pressure Regulating Valve, P2 ≧Engine Inlet Pressure, P3+0.05MPa



(Example)

HFO	Eng. Inlet Temp. Std.
180mm²/s	120～130℃
380mm²/s	135～145℃
700mm²/s	147～157℃

Recommended Eng. Inlet Viscosity:11～14cst

Table. HFO Viscosity Diagram (Excerpt from Operation Manual)

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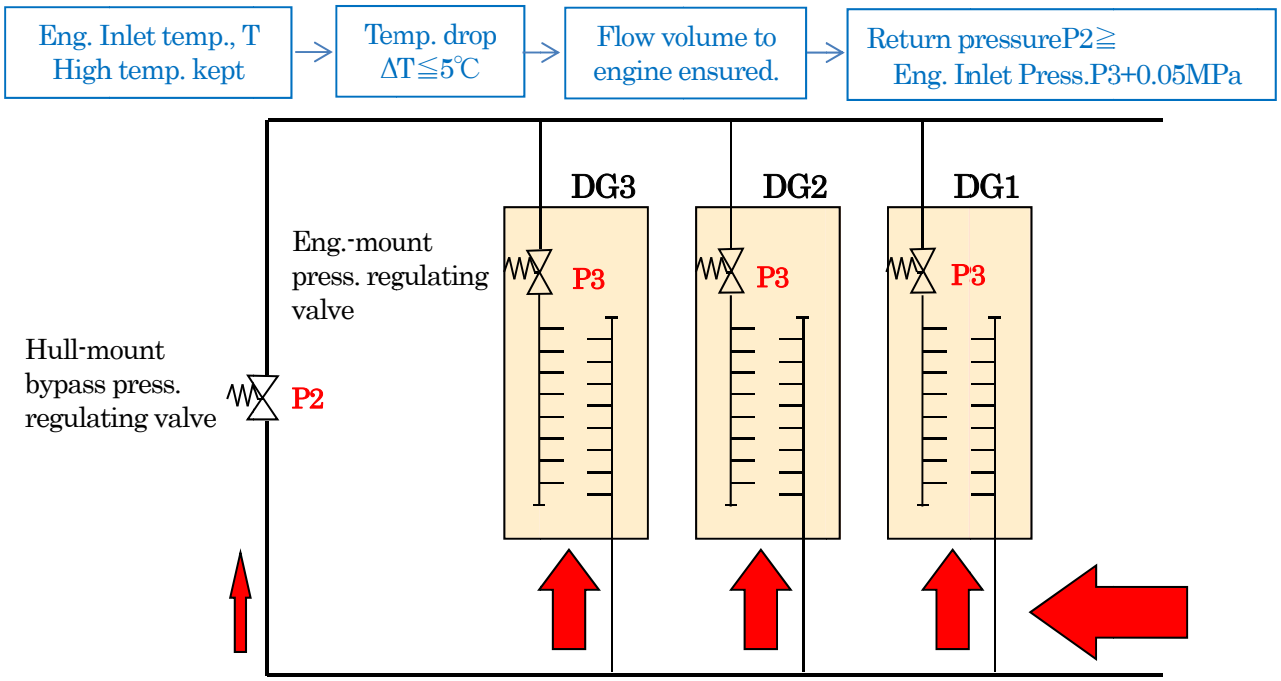


Fig.1 FO System Pressure Balance

2.Faulty FO Injection

Adjust the FO injection valve every 1500~2000 hours, (first time, after 500~800 hrs.) to ensure normal FO injection, (see instructions of the operation manual).

3. Turbocharger Performance Drop

(1) Turbine Wheel Contamination

Clean the turbine appropriately according to the inspections of the operation manual.)

(2)Increase of Clearance between Nozzle Ring and Exhaust Casing, (Clearance Q)

In the MET18 turbocharger, though after overhaul, exhaust gas temperature rose. The turbocharger manufacturer, Mitsubishi Heavy Industries Marine Machinery & Engine Co., Ltd, as a result of their survey on this problem, reported to us that the turbocharger performance dropped due to the increase of clearance between the nozzle ring and exhaust casing, (Clearance Q). Carbon was removed by the maintenance cleaning and the increased Q-clearance was exposed as a result. We project that this caused the exhaust temperature to rise soon after conducting maintenance.

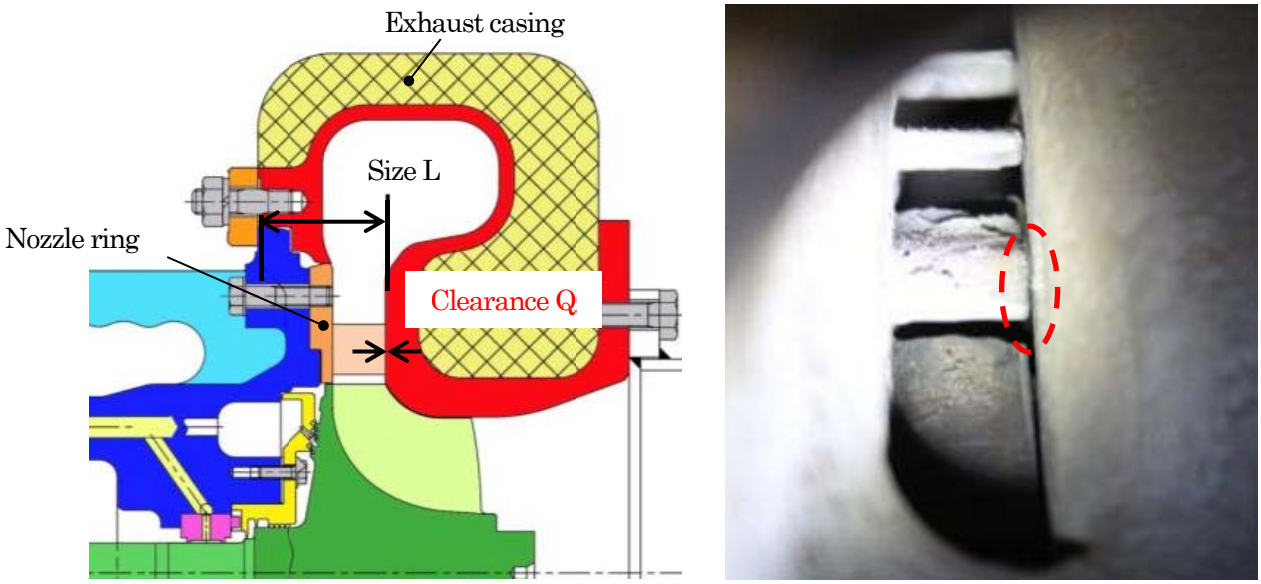
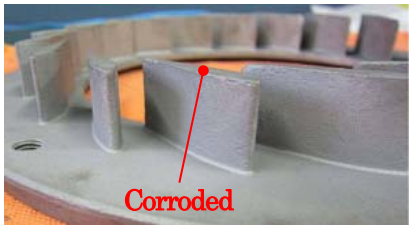
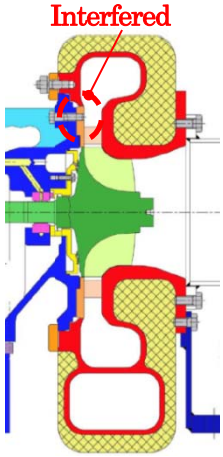
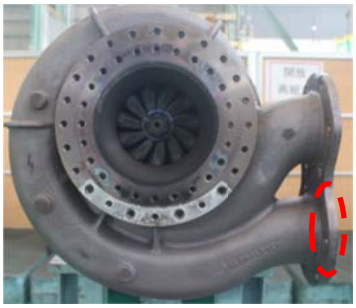


Fig.2 Increase of Clearance between Nozzle Ring & Exhaust Casing (Clearance Q)

①Cause of Trouble and Improvement

Cause	Improvement
【Corrosion Wastage of Nozzle Ring】 Nozzle ring caused corrosion wastage due to high oxidation corrosion, which contributed to increase the Clearance Q.  	【Nozzle Ring Material and External Diameter Change】 ・In order to increase acid resistance, heat resistance and extreme temperature strength, the material was changed as follows: SS400(machined) → SCS1(casted) ・In an aim to avoid interference caused by thermal expansion, the external diameter was diminished by 0.2mm. 【Discrimination】 Check the mfg. number punched on the nozzle ring surface and the rear casting surface. (Example) JPC-1234 ↓ Improved type  Casting surface (4 positions)  【Applicable Engine No.】 7249～7251,7371～7385,7389～7403,7407～7409, 7416～7419,7433～7441,7446～7448,7452～7454, 7458～7466,7473～7490,7494～
【Nozzle ring rolled back】 As a result of FEM analysis, we found that the exhaust casing interfered with the nozzle ring outer circumference due to thermal expansion to cause distortion. However, this failure is corrected upon installing the exhaust casing. Accordingly, this factor gives only very small effect to the turbocharger performance drop.   	
【Distortion of Exhaust Casing】 We found that the distance between the installation flange face and the opposing nozzle face, (Size L in Fig.2), is distorted due to thermal stress for deformation, which contributed to increase the Q-clearance. However, the distortion was extremely small. Accordingly, this factor gives only very small effect to the turbocharger performance drop	【Exhaust Casing Material Change】 To increase strength against thermal stress, the material was changed as follows: FCD450 → Hi-Si ductile 【Discrimination】 Check the mfg. number punched on casing. (Example) 15S-1257H ↓ Improved type  【Applicable Engine No.】1840,1841,1855～

②Corrective Measure

As shown in the diagram below, it is possible to control the Q-clearance expansion by changing the present item to the improved nozzle ring. When the exhaust temperature rise is suspected due to Q-clearance expansion and performance drop, please inform to your Yanmar contact.

The exhaust casing needs not be replaced since the distortion was extremely small as mentioned above.

Clearance Q increase according to time

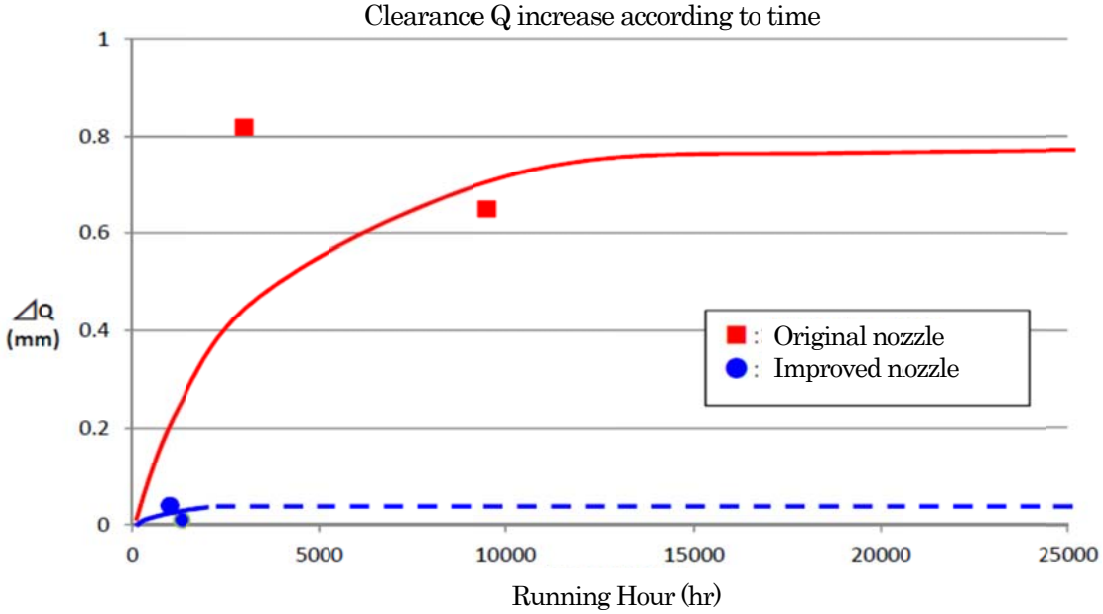


Table 2. Part Number of Improvement Nozzle Ring

Part No.	Engine Model	Output(kW)	Rotation(min^{-1})	Fuel Oil
146621-19330	6EY18ALW	800	900, 1000	HFO, MDO
		745		
		680		
		660		
		615		
146621-19340		550		
		500		
		455		
146623-19330	6EY18AL	800	900, 1000	HFO, MDO
		745		
		680		
146623-19340		660		
		615		
146623-19350		550	900	
		500		
		455		
146623-19360		550	1000	
		500		
		455		
146625-19330	6EY18L	615	720, 750	HFO, MDO
146625-19340		550		
		500		
		450		
146625-19350		400		

Attached Material : MET18 Turbocharger Performance Interview Sheet (TZ-E002-4653)

過給機性能問診票　Turbocharger Performance Interview Sheet　　MET Turbo TZ-E002-4653

船名/Ship name	機関型式/Engine Model	機関番号/Engine Serial No.	過給機型式/Turbocharger Model	過給機製造番号/Turbocharger Serial No.

1	排気温度は整備後に高くなったものでしょうか？ Did gas inlet temperature become higher after overhaul?	□ YES □ NO	
2	総運転時間、最後の開放点検日時とその際の運転時間を教示下さい。 Kindly report to MHI about Total running hour/ date of latest overhaul & the running hour at the time)	総運転時間/Total running hour:	hr
		最後の開放点検日時とその際の運転時間 Date of latest overhaul & the running hour at the time	日付 Date 運転時間 Running hour　hr

3	就航直後と、直近のデータを教示ください。 Kindly report to MHI about the operation data (Refer right table)		就航直後 Just after delivery	就航 6 か月後 6months after delivery	直近のデータ Last data	清掃 Cleaning 前 Before	清掃 Cleaning 後 After
		日時 Date					
		ガス入口温度 Gas inlet temp [degree]					
		ガス出口温度 Gas outlet temp[degree]					
		給気圧力 Boosted air pressure [MPa]					
		機関室温度 ENG room temp （suction air temp） [degree]					
		エアクーラー冷却水温度 Cooling water temp for air cooler	In				
			Out				

4	整備をした実績があればその前後の運転データも教示願います。 If the actual result of overhaul maintenance, report to us the data(before & after overhaul)	
5	直近の整備時の記録（隙間記録含）を教示願います。 各隙間は許容値内でしょうか？ Kindly repot the latest overhaul record (with clearance table)/(Are they under our design or limit?)	隙間 A,W, H, V, H を確認ください。 Check the Clearance A,W, H, V, H
6	直近の整備時の部品状況を写真にて教示願います。 Kindly send the latest photo of each parts (at overhaul) to MHI	
7	主要部品（ノズル/ガスケーシング/羽根車/ディフューザ）の交換履歴があれば、その内容（日時含む）を教示願います。 If there is record of main part replacement (nozzle/gas casing/compressor /diffuser), kindly tell us about detail with the replacement data.	
8	ガスケーシングと軸受台の間にある軟鋼パッキンが 2 枚重ねになっていないでしょうか？ Was the steel packing (p.No.309) used double sheets ? It leads to bigger turbine side gap	□ YES □ NO