Economizer Analysis on Thermal Oil Heating Process

Economizer analysis on thermal oil process means to prove is done because there are differences data between the maker's data with the shop test data of the main engine.
The following table will show the technical data of economizer, thermal oil fluid, and shop trial record of main engine used.

Technical Data of Economizer				Thermal Oil Fluid Specification			
Type	=	Aalborg EXV632 46 48.3 900DD		**Type**	=	Therminol 66	
Quantity	=	23,7	m^3/h	**Composition**	=	Hydrogenated Terphenyl	
T_{inlet}	=	140	^oC	**Kinematic Vis. (40^oC)**	=	29,64	cSt
T_{Outlet}	=	180	^oC				
Flow Resistance	=	17,5	m.l.c	**Density (15^oC)**	=	1011	kg/m^3
Diameter Without Insulation	=	1664	mm	**Flash Point**	=	170	^oC
				Fire Point	=	216	^oC
Weight (Empty)	=	6200	kg	**Total Acidity**	=	<0,02	mgKOH/g
Liquid Contents	=	1190	Litres	**Pour Point**	=	-32	^oC

Shop Trial Record of Main Engine on MT. Parigi					
Engine Load (%)	**Engine Output (kW)**	**Exh. Gas T/C Inlet (^oC)**	**Exh. Gas T/C Outlet (^oC)**	**Specific Heat of Exh. Gas (kJ/kgK)**	**Exhaust Gas Amount (kg/h)**
75%	3330	365	225	1,030	21670
85%	3774	380	225	1,030	26862
100%	4440	420	240	1,033	35757

Engine load 85 (%)

- Capacity:.....500 kW
- Exhaust gas quantity:.....33.300 kg/h
- Exhaust gas temperature before heater.....248 °C
- Exhaust gas temperature after heater.....197 °C
- Pressure drop exhaust gasses.....1.232 Pa.

Engine load 100 (%)

- Capacity:.....619 kW
- Exhaust gas quantity:.....37.200kg/h
- Exhaust gas temperature before heater.....265 °C
- Exhaust gas temperature after heater.....209 °C
- Pressure drop exhaust gasses.....1.545 Pa.

Therefore, the analysis will be done in order to find out the outlet temperature of exhaust gas from the economizer, at 75%, 85%, and 100% MCR of the main engine.

Analysis on 75% Load of Main Engine

Heat of thermal oil fluid will be kept constant. The heat value of thermal oil fluid is as following.

$Q_{TO} = m_{TO} \times Cp_{TO} \times \Delta T_{TO}$

$= 483{,}162$ kW

Then, find out the outlet temperature of exhaust gas from the economizer.

$Q_{TO} = Q_{EG}$

$T_{EGout} = 420{,}196$ K

$= 147{,}046$ ^{o}C

Based on calculation above, it is known that the outlet temperature of exhaust gas from the economizer at 75% load of main engine is 151,72 ^{o}C.

Analysis on 85% Load of Main Engine

Heat of thermal oil fluid will be kept constant. The heat value of thermal oil fluid is as following.

$Q_{TO} = m_{TO} \times Cp_{TO} \times \Delta T_{TO}$

$= 483{,}162$ kW

Then, find out the outlet temperature of exhaust gas from the economizer.

$Q_{TO} = Q_{EG}$

$T_{EGout} = 435{,}264$ K

$= 162{,}114$ ^{o}C

Based on calculation above, it is known that the outlet temperature of exhaust gas from the economizer at 85% load of main engine is 166,5 ^{o}C.

Analysis on 100% Load of Main Engine

Heat of thermal oil fluid will be kept constant. The heat value of thermal oil fluid is as following.

$Q_{TO} = m_{TO} \times Cp_{TO} \times \Delta T_{TO}$

$= 483{,}162$ kW

Then, find out the outlet temperature of exhaust gas from the economizer.

$Q_{TO} = Q_{EG}$

$T_{EGout} = 466{,}048$ K

$= 192{,}898$ ^{o}C

Based on calculation above, it is known that the outlet temperature of exhaust gas from the economizer at 85% load of main engine is 196,3 ^{o}C.