Action code: WHEN CONVENIENT

SO_x scrubber retrofit on two-stroke engines in service

SL2018-665/MET
September 2018

Concerns
Owners and operators of MAN B&W two-stroke marine diesel engines.
Type: MC/MC-C, ME/ME-C

Summary
MAN PrimeServ offers a SO_x scrubber retrofit package with recommendations on the turbocharger rematching parts.

Dear Sir or Madam

On 1 January 2020, the global sulphur (S) cap on marine fuels will be reduced from 3.50% to 0.50% S (Fig. 1). This landmark decision, which will have a major impact on the marine industry, was taken in 2016 at the 70th session of IMO's Marine Environment Protection Committee (MEPC 70). However, the continued use of high-sulphur HFO is allowed provided that an exhaust gas cleaning (EGC) device is installed and certified, to comply with the new sulphur regulations.

Operators of MAN B&W two-stroke marine engines have the following three options for operation in global waters:

1. Operate on 0.50% very-low-sulphur fuel oil (VLSFO) or a fuel with lower sulphur content
2. Operate a dual fuel ME-GI or ME-LGI type engine on LNG, ethane, methanol or LPG
3. Continue operation on high-sulphur fuels and apply an EGC device such as a SO_x scrubber.

This Service Letter informs about the impact and required action if an owner/operator decides to retrofit a SO_x scrubber on an MAN B&W two-stroke engine in service. Such a decision calls for a comprehensive project approach, as retrofitting a SO_x scrubber may require engine modifications and a technical file amendment to ensure continued compliance with IMO's NO_x Technical Code 2008.

Yours faithfully

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Retrofit, Upgrade & Engine Management

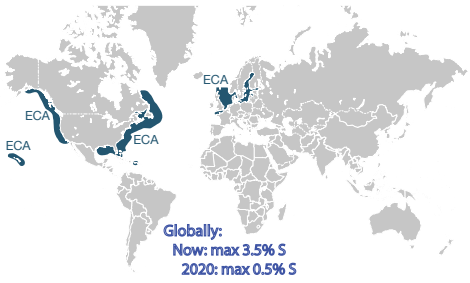

Fig. 1: World map illustrating major sulphur emission controlled areas (SECAs) and the sulphur limits in force

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MAN Energy Solutions is not a SO_X scrubber maker. Accordingly, the SO_X scrubber maker and the shipowner must handle the SO_X scrubber layout/EGC system, installation arrangement, vessel installation interfaces, and SO_X emission compliance plan.

MAN PrimeServ offers a SO_X scrubber retrofit package with recommendations on the turbocharger rematching parts as well as related re-certification work for the engine modifications carried out and approval with relevant classification societies.

Evaluation prior to SO_X scrubber installation

Shipowners wishing to investigate whether a SO_X scrubber is feasible for a particular engine will need the exhaust gas data for the engine in question. In this connection, we can provide the relevant exhaust gas data at the espected SO_X scrubber layout engine power (% of MCR) and make calculations for specific engine loads. Further details are listed in the section “Engine tuned for a SO_X scrubber” on the engineering services offered by MAN PrimeServ.

If the shipowner decides to install an EGC with part-load layout, the EGC cleaning capacity has to be matched for the specified part-load layout. The engine must always be able to run at 100% MCR, hence the EGC layout (exhaust-gas path) must be designed for 100% MCR gas flow, unless an exhaust-gas path bypass is installed.

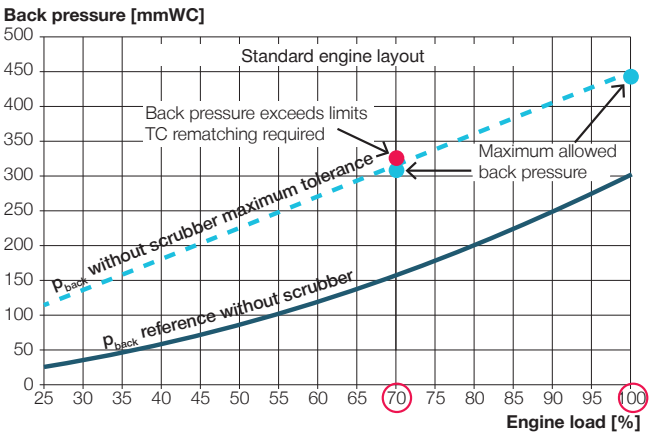

Fig. 2: Standard engine back pressure layout

Fig. 2 shows the engine back pressure curve of a standard engine. The bottom curve shows the reference back pressure of the engine over engine power. The top curve shows the maximum engine back pressure allowed over engine power. The actual values of the back pressure at different engine loads are shown in Table 1.

When a SO_X scrubber is installed, the back pressure might increase above the maximum back pressure curve allowed. If so, a turbocharger rematching along with an amendment to the Technical File is required.

Furthermore, if the engine back pressure measured plus the added back pressure of the SO_X scrubber is between the two curves, MAN Energy Solutions strongly recommends that the engine performance is evaluated in detail by MAN PrimeServ for further potential turbocharger rematching, including a mandatory amendment to the Technical File.

The turbocharger rematching will ensure that the fuel oil consumption will be as optimal as before installation of a SO_X scrubber, that the NO_X emission level will stay unchanged, and that the engine heat load will stay within range of experience.

Engine tuned for a SO_X scrubber

Fig. 3 shows the engine back pressure after SO_X scrubber installation, turbocharger rematching and amendment to the Technical File. The actual values of the back pressure at different engine loads are shown in Table 2.

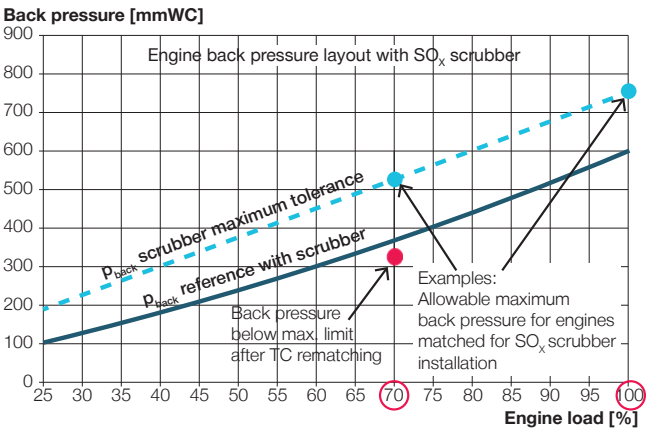

Fig. 3: Engine back pressure layout-tuned for SO_X scrubber installation

Table 1: Back pressure data over engine load (% of MCR) for standard engine

Power (%)	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Ref. p_{back}	25	35	46	58	72	86	102	119	138	157	178	200	223	247	273	300
Max. p_{back}	115	137	159	182	204	227	249	271	294	316	339	361	383	406	428	450
Tolerance p_{back}	90	102	113	124	132	141	147	152	156	159	161	161	160	159	155	150

Table 2: Back pressure data over engine load (% of MCR) for engine tuned for SO_X scrubber

Power (%)	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Ref. p_{back}	100	125	151	178	207	237	268	300	333	368	403	440	479	518	558	600
Max. p_{back}	188	226	263	301	338	376	413	450	488	526	563	600	638	676	713	750
Tolerance p_{back}	88	101	112	123	131	139	145	150	155	158	160	160	169	158	155	150

The bottom curve shows the reference back pressure of the engine over engine power. The top curve shows the maximum engine back pressure allowed over engine power. The back pressure with the SO_X scrubber installed must be below the maximum back pressure curve allowed regardless of engine load.

The red dot in Fig. 2 illustrates an engine with a SO_x scrubber installed, which results in a total back pressure of 325 mmWC. In Table 1 it can be seen that the maximum allowed back pressure at 70% load is 316 mmWC, hence in this case it is mandatory to do a turbocharger rematching and an amendment to the Technical File. In Fig. 3, the engine has been tuned for the SO_x scrubber, and the red dot shows that it is now below the maximum back pressure tolerance curve. The engine is now compliant with the back pressure limit, as described in the Technical File, and the engine performance is now as optimal as before the SO_x scrubber installation.

MAN PrimeServ services

In the following we summarise the services offered by the Retrofit & Upgrade and the Technical Service departments in connection with retrofitting a SO_X scrubber to an engine in service.

MAN PrimeServ engineering service assistance

Retrofit & Upgrade

– contact: dr-cph@man-es.com

1. Engine exhaust gas data at 100% MCR - brief SO_X scrubber layout (List of capacities)
2. Report 1/2
    a. current engine exhaust gas data at specific engine loads – needed for detailed SO_X scrubber investigation
3. Report 2/2
    b. performance and back pressure measurements on-board by MAN PrimeServ or crew
    c. effect of added back pressure and recommendations for turbocharger rematching
4. Amendment to the Technical File and approval from Classification Society – dependent on back pressure after SO_X scrubber installation and engine modification.

Technical Service

– contact: dt-cph@man-es.com

5. Engine evaluation – pre-scrubber installation (actual engine performance)
6. Sea trial and final adjustment plus on-board verification procedure to demonstrate compliance (performance survey).

Questions regarding this Service Letter should be directed to our MAN PrimeServ Retrofit & Upgrade department (SEACR) at dr-cph@man-es.com.