

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Turbocharger**with type designation(s)
S300, S400, S500

Issued to

BorgWarner Turbo Systems, Inc.
Arden, NC, USA

is found to comply with

DNV GL rules for classification – Ships**DNV GL rules for classification – High speed and light craft****Application :****The turbochargers are approved for use on internal combustion engines with application data as given in the certificate. Products approved by this certificate are accepted for installation on all vessels classed by DNV GL.**Issued at **Hamburg** on **2018-08-02**This Certificate is valid until **2023-08-01**.DNV GL local station: **Houston**for **DNV GL**Approval Engineer: **Sven Neddenien**

Burkhard Lilienthal
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.



Job Id: **262.1-027108-1**
Certificate No: **TAM00000XW**

Product description

Exhaust driven turbochargers served by cylinder groups with combined power below 1000 kW.

Alternative place of production

not applicable

Application/Limitation

Maximum operational speed and exhaust gas temperature for turbochargers:

Turbocharger model	Turbine wheel diameter (mm)	Compr. wheel diameter (mm)	$n_{\max}$ (rpm)	$T_{\max}$ (°C)	design lub. oil pressure (bar)	min. lub. oil pressure (bar)	Max. pressure ratio
S300	74	83	120 000	680	3.4	1.36	3.86
S330	76	83	120 000	680	3.4	1.36	3.50
S330	76	87	115 525	703	3.4	1.36	3.80
S410	80	91	117 000	736	3.4	1.36	3.80
S430	83	95	117 800	758	3.4	1.36	3.90
S410	83	96	100 200	736	3.4	1.36	3.50
S410	96	105	90 000	680	3.4	1.36	3.10
S510	100	110	93 000	680	3.4	1.36	3.80
S510	110	120	75 100	599	3.4	1.36	3.40

The stated speeds and temperatures are the highest allowed values and should not be exceeded at any time, nor at engine overload (110%).

Type Approval documentation

Tests carried out

Type test Caterpillar C18 with S400 turbo charger, March 2007, Mossville, USA

Type test Caterpillar C9.3 with S300 turbo charger, November 2014, Mossville, USA

Durability tests, S510WG turbo charger, June 2014

Availability report of S500 turbo charger at Caterpillar C32

Marking of product

The product is to be marked with manufacturer's name or trademark and type or model identification.

Periodical assessment

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

The objective of the Periodical Assessment is to verify that the conditions for the Type Approval are not altered since the Type Approval certificate was issued.

In cases where the type approved product is manufactured at other companies, periodical assessments shall be carried out randomly at these companies. All companies shall be assessed at least once in the period of validity of the TA certificate.

This will be according to Class Guideline DNVGL-CG-0338, Section 4.

Other conditions

Turbochargers are categorized in three categories depending on power served by each turbocharger:



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Category A = ≤ 1000 kW, Category B = > 1000 kW and ≤ 2500 kW, Category C = >2500 kW.

Turbochargers shall be delivered with a product certificate issued by the manufacturer (category B) or by the class society (category C). For turbochargers of category A a certificate is not mandatory.

END OF CERTIFICATE