14 cylinders and more cylinder power for the Sulzer RTA96C

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The development of larger container liners is picking up speed. Ships of 5000 – 7000 TEU capacity are now becoming commonplace, and several owners are giving increasingly serious consideration to larger vessels of some 8000 TEU or more, while shipbuilders are even looking at 12,000 TEU vessels. Thus, earlier this year became an appropriate time for us to release increased power outputs for the Sulzer RTA96C engine, which is already powering many of today's largest container liners.

The first step, which is immediately available for new engines, is an increase in the power per cylinder from 5490 kW to 5720 kW at 102 rev/min, maximum continuous rating. This raises the output of the 12-cylinder RTA96C engine to 68,640 kW. Sulzer RTA96C engines now give exactly the same power outputs as competitor's engines of similar size.

Yet even more power becomes available with the addition of a 14-cylinder engine of the Sulzer RTA96C type. This develops 80,080 kW, which will be adequate for single-screw Post-Panamax container liners up to about 10,000 TEU sailing at service speeds up to 25 knots. This is the world's first 14-cylinder in-line low-speed engine to be offered by any engine designer. Various cylinder numbers, such as 14, 16 and even 18, have been discussed in recent years, but the Sulzer 14RTA96C is the first 14-cylinder type to be officially released in a production engine programme.

Of course, one is immediately curious about the dimensions of such a behemoth. It is really not much larger than the established 12-cylinder RTA96C. It measures about 27.31 m long overall to the flywheel flange by 10.93 m high over the shaft centreline, or 13.54 m overall, and weighs 2300 tonnes, dry. This compares with 2050 tonnes for the 12-cylinder engine. One could say here that the individual elements of the 14-cylinder engine, such as the two crankshaft sections, reach about today's maximum lifting capacities of the engine makers, such that 14 is about the limit for the number of cylinders.

Even more, the camshaft for engines with more than 14 cylinders would need to be split into three parts, and (at least) two camshaft drives would become necessary. Consequently, if more than 14 cylinders were needed, the only appropriate solution would be the RT-flex version of the engine with

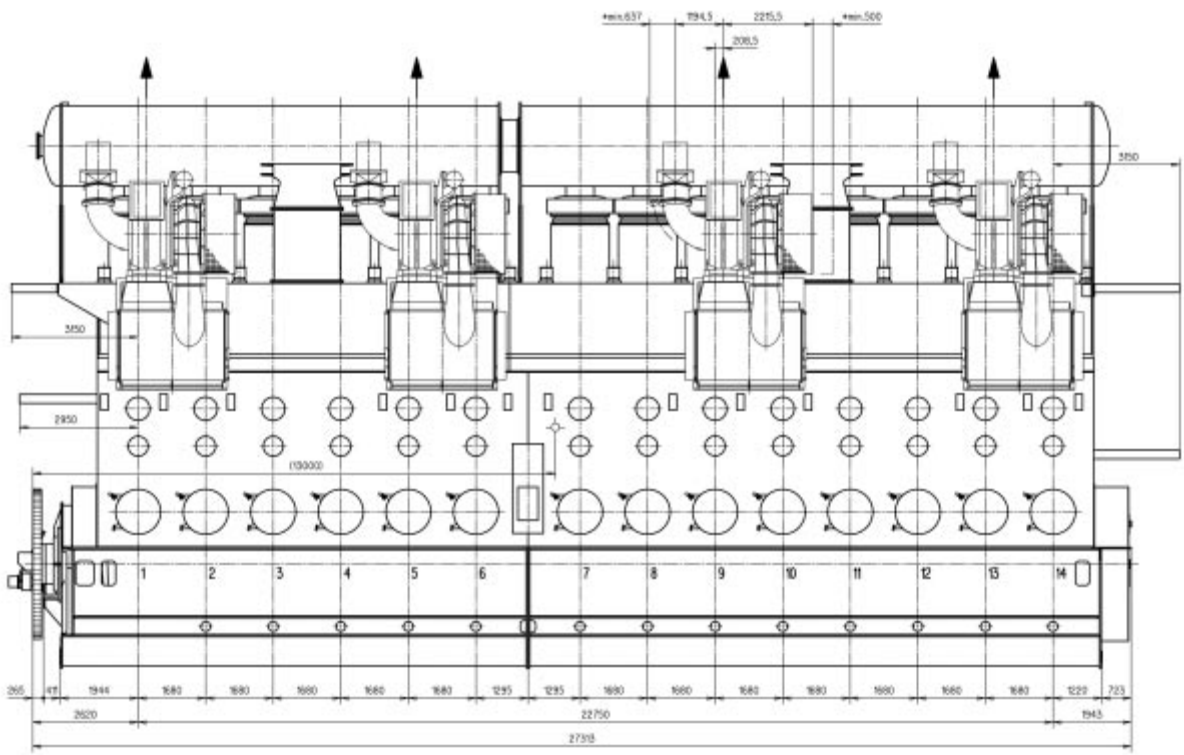

Fig. 1 Side elevation of the 14-cylinder Sulzer RTA96C. It measures 27.31 m long overall to the flywheel, and 13.54 m tall.

Fig. 2 Fitting the crankshaft into the bedplate of an RTA96C engine.

Principal particulars of the Sulzer RTA96C

		old rating	new rating
Bore	mm	960	960
Stroke	mm	2500	2500
Power MCR (R1)	kW/cylinder bhp/cylinder	5490 7470	5720 7780
Speed (R1)	rev/min	100	102
BMEP	bar	18.2	18.6
Mean piston speed	m/s	8.3	8.5
Maximum pressure	bar	142	145
Cylinders:		6 - 12	6 - 12, 14
Power, 12-cylinder engine	kW bhp	65,880 89,640	68,640 93,360
Power, 14-cylinder engine	kW bhp	– –	80,080 108,920
Fuel consumption, BSFC at full load:	g/kWh g/bhph	171-163 126-120	171-163 126-120

common-rail systems for fuel injection and valve actuation.

The additional challenges in designing and building such a large engine are not overwhelming, although going further to 16 or even 18 cylinders in-line will not be without problems. For 14 cylinders, the engine is barely 3.36 m, or less than 15 % longer than the 12-cylinder engine. Thus the longitudinal and torsional rigidity of the engine will be quite adequate for the expected ship structures. The torsional vibration characteristics are also acceptable for the envisaged firing order. The crankshaft material and the shrink fit of the journals in the webs will, however, be re-defined to suit the increased torque transmitted to the propeller shaft. Curiously, with such large engines, one starts to see items such as the auxiliary scavenge air blowers becoming significant. In the 14RTA96C, the auxiliary blowers impose a combined electrical demand of 400 kW.

Increased cylinder outputs

The increased outputs of the Sulzer RTA96C engines are made possible by the very satisfactory service experience with the large number of RTA96C engines currently in service since they first began operation some three and a half years ago in October 1997. At the end of March 2001, a total of 86 RTA96C engines with eight, nine, ten, 11 and 12 cylinders in-line are in service or on order, having an aggregate output of 4875 MW (6.63 million bhp). Of these, 27 engines are in service.

Particular note must be taken of the low wear rates being achieved by RTA96C engines in service – diametral cylinder liner wear in the order of only 0.03 mm/1000 hours. Further information on the service experience with the RTA96C is reported in the previous issue of Marine News 3-2000, pages 6–10.

The new RTA96C engines have the same dimensions and masses as the existing RTA96C engines built to the latest design standard. They also have exactly the same brake specific fuel consumption (BSFC) and cylinder lubricating oil feed rate. Their times between overhauls are expected to be three years for major components. The NOx emissions of the RTA96C are within the limits set by the IMO regulation in Annex VI of the MARPOL 73/78 Convention.

So where does one go further upwards in power from here? As noted above, greater cylinder numbers are currently not considered practicable. Shipowners have shown a great reluctance to accept cylinder configurations other than straight, in-line vertical. If owners really want to build ships of greater than 10,000 TEU capacity then alternatives* such as contra-rotating propellers (greater efficiency, hence more thrust for the same power), twin-engine twin-screw plants, or perhaps single engines of even larger cylinder bore, will come into consideration. We are thus certainly experiencing the old proverb of living in interesting times.

* Some of the alternatives for the propulsion of large container liners are discussed in “Marine News”, 2-2000, pages 20–23. ■