



LEAN PROPULSION



GREEN - LEAN ELECTRIC PROPULSION
FOR HIGH POWER

2025-R4D

STADT LEAN PROPULSION®

Ship owners need *reliable vessels* that are efficient to operate, year after year, in all seasons and weather conditions. Most importantly, the ship must have a *reliable* propulsion system with propellers and power systems that never fail. One that enables them to operate safely anywhere on the planet. As a vendor of conventional PWM propulsion systems for many years, we asked the question: “Can a new way of thinking also give us a new generation of ship propulsion systems that are prepared for tomorrow’s environmental challenges” ?

STADT AS has taken these challenges seriously, when developing the STADT Lean Propulsion®, based on patented, now available for the most powerful applications, more than 50 MW per propeller. A lean propulsion system that is amazingly *reliable*, and also reduces service costs, weight, fuel, emission and waste, while freeing up space. Ready for zero emission solutions.

A sophisticated and silent system performance, documented extremely long lifetime, far ahead of competitors and excellent manoeuvrability.

The new drive technology has been awarded several times for its unique characteristics, and many ships are now sailing with the Lean Drive technology all over the world.



RELIABLE PROPULSION

STADT GROUP AS was established back in 1985 by Hallvard L. Slettevoll. In 2015 a modern STADT Maritime Center was opened in Gjerdsvika harbour.

For many years STADT AS has been a leading company in AC drive innovations. Long experience from development of motor drives has resulted in the *patented STADT Lean Drive technology*. This has huge advantages compared to traditional PWM-technology, since it is *free from electric disturbances*. The STADT Lean Drive is also a very efficient



power drive system and *brings reliability up to a new standard*.

The first STADT electric propulsion delivery went to the Norwegian coastguard K/V Tromsø in 1996, representing a technological breakthrough.



One of the 150 ship propulsion references

The new drive technology has been awarded several times for its unique characteristics and its reliability is well documented over the last 15 years of operation worldwide.

AWARDED TECHNOLOGY LEADER

”The STADT Lean Propulsion® system has features that has not been achieved in previous propulsion solutions. Its most impression feature being is its completely silent, stealth operation, which is already been adopted in a series of naval ships and commercial vessels.

The systems impressive efficiency comes from its very low power loss. At time contributing to lower emissions and a reduced carbon footprint.”

-The RINA awarding committee



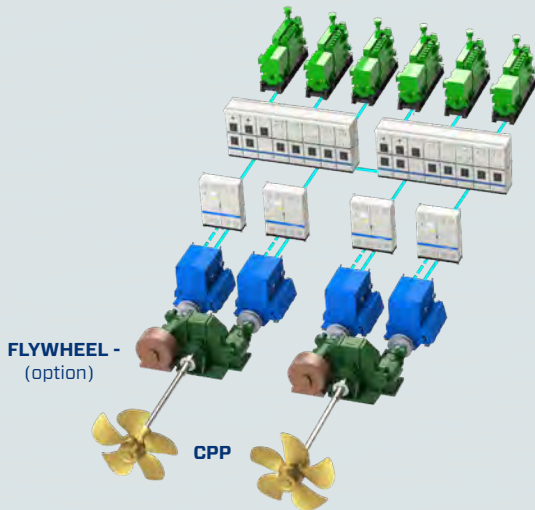
Awarded by The Royal Institute of Naval Architects (RINA) in London



INNOVATIVE PROPULSION FOR YOUR NEXT SHIP

WHEN HIGH POWER IS REQUIRED

ICEBREAKERS, NAVAL SHIPS, TANKERS, CRUISE AND PASSENGER SHIPS



TRANSFORMER-FREE IN
LOW / MEDIUM / HIGH VOLTAGE:

- 690 V AC
- 3300 V AC
- 4160 V AC
- 6600 V AC
- 11000 V AC
- 13500 V AC

STADT LEAN PROPULSION®

SUSTAINABLE, LEAN AND GREEN

Ensures that the propeller never stops.

STADT LEAN PROPULSION WILL GIVE:

- ▲ Reduced fuel consumption
- ▲ High redundancy, long lifetime
- ▲ Reduced maintenance, low OPEX
- ▲ Modular architecture options
- ▲ by The Cube™ standards
- ▲ Slow steaming optimal
- ▲ Reduced NO_x, SO_x, BC and CO₂ emission
- ▲ Power source flexibility



LEAN DRIVE FOR ANY SIZE OF SHIPS - SCALABILITY UP TO 100 MW

THE MOST IMPORTANT DESIGN CHOISES:

CPP OR FP PROPELLER?

-SEE OUR PRESENTATION

AC OR DC GRID?

-SEE OUR SPECIAL BROCHURE

GEARED OR GEARLESS?

-SEE OUR SPECIAL BROCHURE

LEAN PROPULSION®



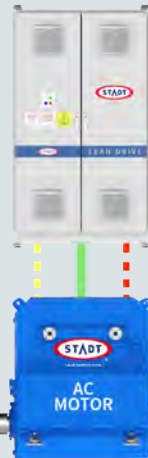
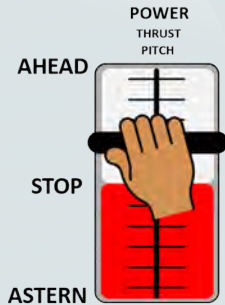
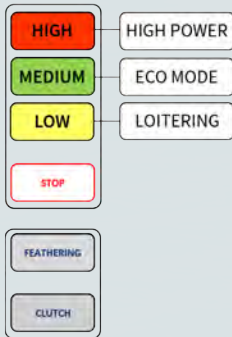
THE CONTROLLABLE PITCH PROPELLER

THE PATENTED STADT LEAN DRIVE COMBINES PITCH AND RPM-CONTROL

- ▲ The perfect propeller for ice classed ships
- ▲ Possible to combine with flywheel in ice conditions
- ▲ Each blade may be changed independently if damaged, at sea
- ▲ CPP's are the propeller type with widest power range - 1 to 75 MW per unit
- ▲ The CPP are available with 4, 5, 6 or 7 blades, giving lowest URN.
- ▲ Better manoeuvrability (acceleration, breaking, crash stop)
- ▲ Eliminating high power braking resistors – no waste energy
- ▲ Possibility for full feathering position, which saves fuel when running only one propeller
- ▲ Future-proof with regard to changes of use of the vessel, slow steaming, extensions, etc.
- ▲ Significantly improved efficiency at varying load / weather / speed conditions



DYNAMIC POWER - AT YOUR FINGERTIPS



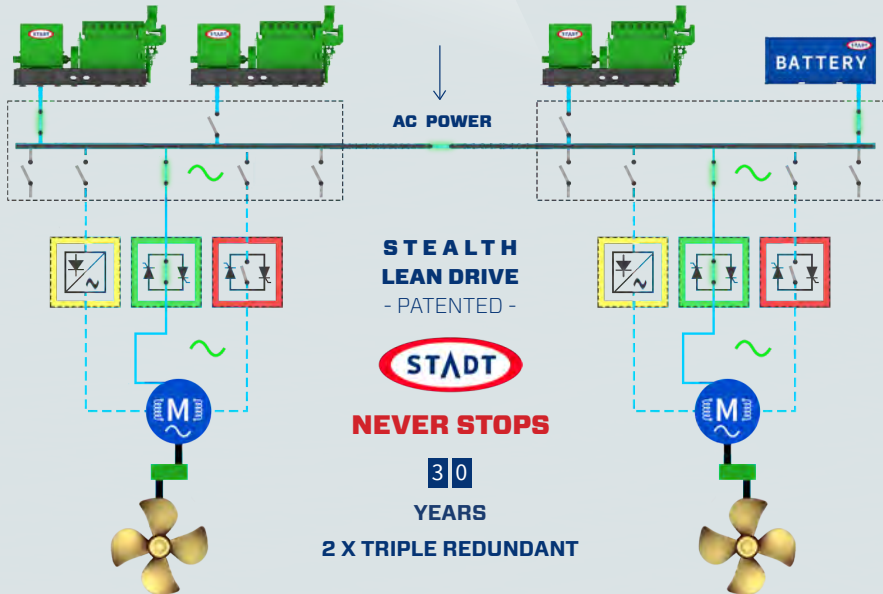
0-80 rpm
0-30.000 kW



Geared transmissions save a lot of weight and space

STEALTH LEAN PROPULSION®

STADT LEAN PROPULSION®

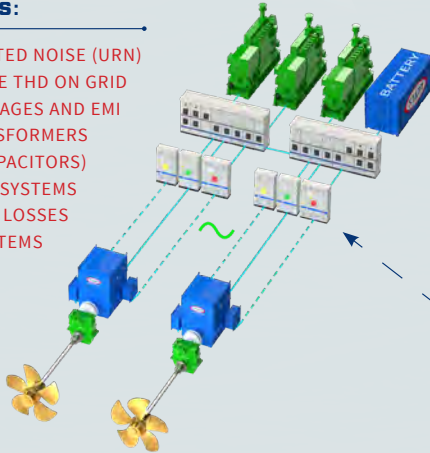


LEAN - WHEN LESS GIVES MORE

STADT ELIMINATES:

- UNDERWATER RADIATED NOISE (URN)
- POWER DISTURBANCE THD ON GRID
- COMMON MODE VOLTAGES AND EMI
- THE BIG DRIVE TRANSFORMERS
- EXPLOSION RISK (CAPACITORS)
- BREAKING CHOPPER SYSTEMS
- 6 % WASTED ENERGY LOSSES
- WATER COOLING SYSTEMS
- 80.000 COMPONENTS
- SCREENED CABLES
- COMPLEXITY

= **LESS DOWNTIME**



STADT GIVES YOU MORE:

- + REDUNDANCY IN DRIVE SYSTEM
- + POWER TO PROPELLER
- + SAFETY AND RELIABILITY
- + SPACE AND LOWER WEIGHT
- + STEALTH PERFORMANCE
- + HMS AND COMFORT (SILENCE)

= **BETTER PERFORMANCE**

HOW COME ?

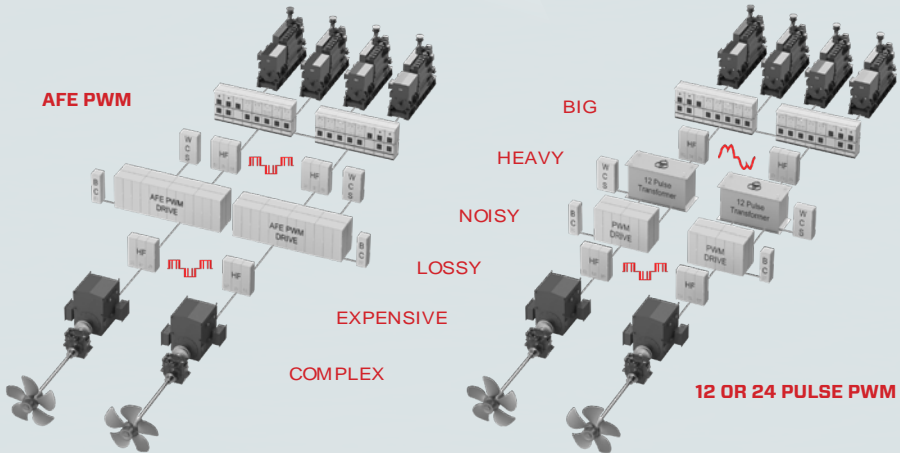
PATENTED, DYNAMIC -
ULTRA LOW FREQUENCY
SWITCHING TECHNOLOGY.

WHY DISTURB PERFECTION ?

STADT LEAN PROPULSION®

PWM WILL NEVER BE STEALTH OR NOISE-FREE

Complex PWM Drives (for comparison), competitor's technology

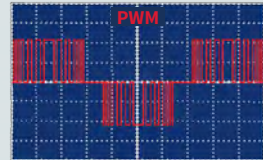


PWM = PULSE WIDTH MODULATION



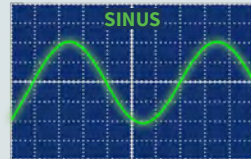
PWM OR LEAN DRIVE - THE DIFFERENCE

- ^ **PWM (Pulse Width Modulated AC)** is an artificial chopped waveform
 - ^ Created by AC to DC to AC conversion via the transistor inverter
 - ^ Power-loss both in drive and transformers
 - ^ Represent a variety of disturbance issues and will create :
 - ^ Common mode noise, EMI, THD, URN and audible noise
 - ^ Stress on EI-motor bearings and windings
 - ^ Hidden failures, also on other equipment on the same grid – **high failure rate**



→ **PWM is a complex technology - power loss & heat - challenging installation**

- ^ **STADT LEAN PROPULSION®** is based on Perfect Sinusoidal Waveform
 - ^ No disturbance due to **Dynamic Ultra Low Frequency Switching Technology**
 - ^ Low audible Underwater Radiated Noise (URN)
 - ^ Minimum loss - no heat generation – no need for water-cooling
 - ^ Represents the **perfect source for our AC induction motors**
 - ^ **Lowest** failure rate



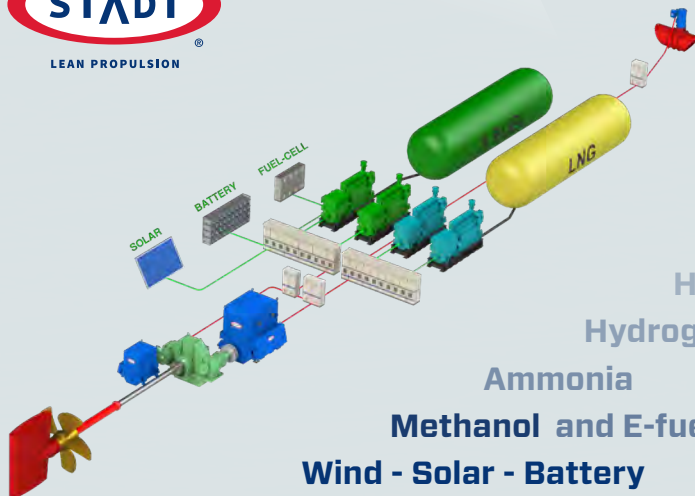
→ **Sinus is simplicity - efficiency - increased reliability - eased installation**

...so why disturb perfection ?

EVALUATION OF TODAY'S DIFFERENT DRIVE SOLUTIONS

Lean Issues To Consider	STADT Stealth Lean Drive	12 Pulse or 24 Pulse	AFE (Active Front End)
Technology in AC drive	Sine Wave	PWM	PWM
No. of electric energy transformations	0	4	4 or 5
Power Train Losses in Drive	0,1 %	6 %	6 - 7 %
Cooling Type	Air is sufficient	Water	Water
Power Transformers Needed	No	Yes	Sometimes • - - ,
Regenerates Power to Grid	Yes	No	Yes ▼
Weight & Size of Drive System	100 %	500 % - 600 %	450 % - 700 %
All Voltage Class (220V-15kV)	Yes	No	No
Underwater Radiated Noise (URN)	Lowest	High	High
Harmonic Distortion (THD)	No	High	High
Common Mode Voltages and EMI	No	High	High
Acoustic Switching Noise and URN	No	Yes	Yes
Screened Power Cables needed	No	Yes	Yes
Redundant Power Units	Standard	Special	Special
Designed Economic Lifetime	40 Years	6 Years	6 Years
Maintenance Requirement	Very Low	Frequent	Frequent
Onboard Crew Skills	Ordinary	Special	Special
MTBF (mean time between failures)	7 Years	1 Year	1 Year
MTTR (mean time to repair)	1 Hour	1 Week	1 Week
Spares Globally Available	Yes	No	No
No. of Power Components in Line	1	80 000	150 000
Capacitors In Main Power Circuit	No	Yes	Yes
Explosion Risk in Drive	No	Yes	Yes
Financial Risk (Service cost, Off-hire)	Very Low	High	High

STADT HYBRID



HVO

Hydrogen

Ammonia

Methanol and E-fuels

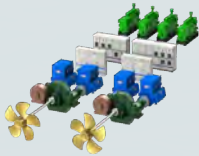
Wind - Solar - Battery

LNG - BioGas - BioFuel - MDO

ANY COMBINATION IS POSSIBLE

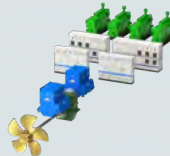
STADT LEAN PROPULSION® ARRANGEMENTS - IEP

SOME BASIC ARRANGEMENTS FOR FULL ELECTRIC PROPULSION
(BATTERY OR FUEL CELL OPTIONS AVAILABLE IN ALL CONFIGURATIONS)



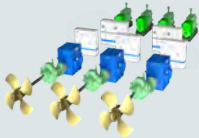
Twin screw w/Flywheel, CP

- ▲ 4 generators
- ▲ 4 electric motors
- ▲ 2 flywheels
- ▲ 2 main switchboards



Single screw Twin, CP

- ▲ 4 generators
- ▲ 2 electric motors
- ▲ 2 main switchboards



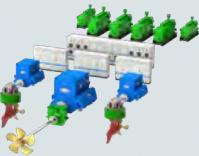
Triple screw, CP

- ▲ 4 generators
- ▲ 3 electric motors
- ▲ 2 main switchboards



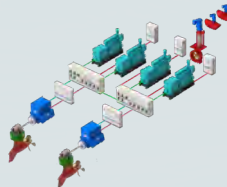
Twin screw (Azimuth), CP

- ▲ 4 generators
- ▲ 2 electric motors
- ▲ 2 main switchboards



Triple screw (2 Azipulls), CP

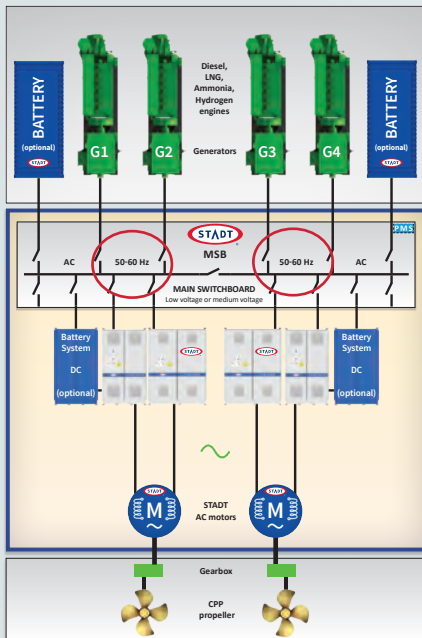
- ▲ 6 generators
- ▲ 3 electric motors
- ▲ 1 main switchboard
with Bus-Tie



Twin screw (2 Azipulls), CP

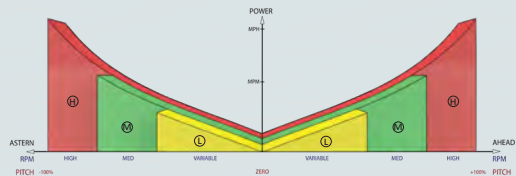
- ▲ 4 generators
- ▲ 2 electric motors
- ▲ 2 main switchboards
- ▲ 2 BT, 1 RT DP-2

STADT - YOUR SYSTEM INTEGRATOR



LET US DESIGN YOUR NEW
SUSTAINABLE PROPULSION
SOLUTION

STADT AC VARIGRID IS AN OPTION





LEAN PROPULSION

BEST IN CLASS ELECTRIC PROPULSION

- ^ **RELIABLE** - low maintenance cost
- ^ **HIGH EFFICIENCY** - less than 0.1 % power loss
- ^ **STEALTH SILENT** - no interference / acoustic noise
- ^ **LOW WEIGHT** - more space for cargo
- ^ Ready for **ZERO EMISSION** shipping

LEAN DRIVE FOR ANY SIZE OF SHIPS

REFERENCES



**SK Arctik, SK Atomik, SK Kinetik,
SC Winter, SC Bongkot, SK Dynamik,
Warami, Rawabi 324
AHTSV NCA80E, Nam Cheong**

**Sanco Spirit,
Sanco Star**



Polarlys
Hurtigruten
Ulstein Yard

Normand Pioneer
Multifunctional Offshore Vessel
Solstad Shipping



Midnatsol, Trollfjord
Hurtigruten

REFERENCES



Normand Progress

Multifunctional Offshore Vessel

Solstad Shipping



Geobay

ROV Vessel

Geo Shipping



ORP Ratownik

Naval submarine rescue ship,

Polish Navy



White Rabbit

Trimaran yacht 83x20m

Echo Yard Australia

Bergen Troll, Senja

Tank Vessel

TFDS



THE STADT SCOPE

Delivered to meet any typical ship classification standard.



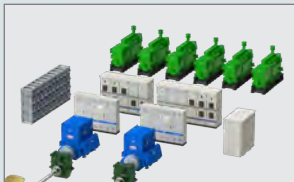
STADT Lean Drives. Scalable in power to more than 50 MW per propeller.



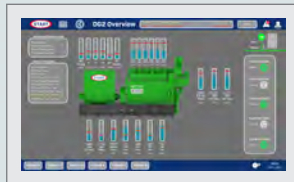
STADT AC motors, asynchronous technology, a broad range.



STADT main switchboards, MCC, low voltage and medium voltage.



STADT power generators, battery systems, shore-to-ship power solutions, distribution transformers, etc.



Power Management System (PMS), IAS, remote access from shore, Dynamic Positioning (DP).

SERVICES and EPC:

- ▲ Engineering of propulsion solutions
- ▲ Manufacturing and installation
- ▲ Commissioning
- ▲ Global Services

STADT GLOBAL NETWORK

STADT SERVICE POINTS:

STADT NORWAY, GJERDSVIKA
STADT ITALY, ROME
STADT SINGAPORE, SINGAPORE
STADT JAPAN, TOKYO
STADT GERMANY, HAMBURG
STADT SPAIN, VIGO
STADT POLAND, GDYNIA
STADT TURKEY, TUZLA
STADT DENMARK, ESBJERG
STADT BALTIC, KLAIPEDA
STADT UK, ABERDEEN
STADT MEDITERRANES, LIMASSOL
STADT NORTH AMERICA, MIAMI
STADT SOUTH AMERICA, RIO DE JANEIRO
STADT KOREA, BUSAN
STADT TAIWAN, KAOHSIUNG
STADT INDIA, MUMBAI
STADT AUSTRALIA, PERTH



STADT OFFICES:

STADT NORWAY, GJERDSVIKA
STADT ITALY, ROME
STADT SINGAPORE, SINGAPORE
STADT JAPAN, TOKYO

STADT HISTORY

40 YEARS IN AC DRIVES



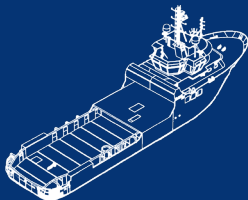
MORE THAN 150 SHIPS AND RIGS ARE POWERED BY **STADT DRIVES**

LEAN BRINGS YOU

- + SAFETY & RELIABILITY
- + VERY LONG LIFETIME
- + SUSTAINABILITY

- + STEALTH & HSE
- + MORE CARGO CAPACITY
- + LONGER ENDURANCE

- + LESS EMISSION AND FUEL
- + COST EFFICIENCY
- + LOWEST URN



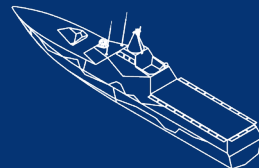
LEAN PROPULSION

STADT AS IS PART OF THE STADT GROUP

STADT AS

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Made in Norway

