SIMPLY THE BEST SOLUTION
FOR ANY NAVAL SHIP
The Navy needs 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 naval propulsion systems that are prepared for tomorrow’s environmental challenges”?

STADT has taken these challenges seriously, when developing the STADT Lean Propulsion®, based on a completely different architecture – a truly revolutionary design, also 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.

A sophisticated and silent system with STEALTH performance, extremely long lifetime, and excellent manoeuvrability. Designed to meet MIL-STD-901 requirements.

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.

Hallvard Slettevoll
Director, CEO
STEALTH AND SAFE PROPULSION

- No electromagnetic interference, EMI, due to sine wave operation
- No acoustic switching noises
- No harmonic voltage distortion, THD, on the ship
- No transformers for the propulsion are needed
- No electric losses in the drives at normal operation
- High redundancy in all levels of the drive systems
- Major reduction of space and weight for the drives
- Minimal need for cooling of drives and its systems
- No need for screened power cables and cable segregation
- Rugged and very well proven technologies
- MTBF and lifetime improved dramatically compared to competitors
- Simplified technology, 80% reduction in number of components

COMPLETE SILENCE
SUSTAINABLE, LEAN AND GREEN:

- Reduced fuel consumption, by slow steaming
- Only 6% losses in systems (AC Motors and alternators included.)
- Reduced NOx, SOx, BC and CO2 emission
- Reduced maintenance and high redundancy

CUSTOMERS EXPERIENCES

«In the past, we were not able to use frequency inverters at all. All PWM inverters interfered with the sensitive equipment on board, and they have therefore been banned from marine environments».

Karl-Axel Olsson
Manager Electric Systems, Kockums ThyssenKrupp Marine Systems
### EVALUATION OF TODAY'S DIFFERENT DRIVE SOLUTIONS

<table>
<thead>
<tr>
<th>Lean Issues To Consider</th>
<th>STADT Lean Drive</th>
<th>12 Pulse or 24 Pulse</th>
<th>AFE (Active Front End)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology in AC drive</td>
<td>Sine Wave</td>
<td>PWM</td>
<td>PWM</td>
</tr>
<tr>
<td>No. of electric energy transformations</td>
<td>0</td>
<td>4</td>
<td>4 or 5</td>
</tr>
<tr>
<td>Power Train Losses</td>
<td>No, (negligible)</td>
<td>6 %</td>
<td>6 - 7 %</td>
</tr>
<tr>
<td>Cooling Type</td>
<td>Air is sufficient</td>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>Power Transformers Needed</td>
<td>No</td>
<td>Yes</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Redundant Power Units</td>
<td>Standard</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Harmonic Distortion (THD)</td>
<td>No</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Electromagnetic Interference</td>
<td>No</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Acoustic Switching Noise</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Screened Power Cables needed</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Depending on Harmonic Filters</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Designed Economic Lifetime</td>
<td>30 Years</td>
<td>6 Years</td>
<td>6 Years</td>
</tr>
<tr>
<td>Maintenance Requirement</td>
<td>Very Low</td>
<td>Frequent</td>
<td>Frequent</td>
</tr>
<tr>
<td>Onboard Crew Skills</td>
<td>Ordinary</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>MTBF (mean time between failures)</td>
<td>7 Years</td>
<td>1 Year</td>
<td>1 Year</td>
</tr>
<tr>
<td>MTTR (mean time to repair)</td>
<td>1 Hour</td>
<td>1 Week</td>
<td>1 Week</td>
</tr>
<tr>
<td>Spares Globally Available</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Weight of Drive System</td>
<td>100 %</td>
<td>1100 % - 1400 %</td>
<td>600 % - 1600 %</td>
</tr>
<tr>
<td>Size of Drive System</td>
<td>100 %</td>
<td>500 % - 600 %</td>
<td>450 % - 700 %</td>
</tr>
<tr>
<td>All Voltage Class (220V-15kV)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Power Scalable</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Regenerates Power to Grid</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>No. of Power Components in Line</td>
<td>1</td>
<td>80 000</td>
<td>150 000</td>
</tr>
<tr>
<td>Capacitors In Main Power Circuit</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Explosion Risk in Drive</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Propeller Pitch Configuration</td>
<td>CP</td>
<td>CP or FP</td>
<td>CP or FP</td>
</tr>
<tr>
<td>Financial Risk (Service cost, Off-hire)</td>
<td>Very Low</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
TECHNOLOGY DIFFERENCES

STADT LEAN PROPULSION ® TECHNOLOGY

STADT LEAN DRIVE

PWM

STADT LEAN DRIVE

SINUS

SINUS

COMPETITOR PWM DRIVE TECHNOLOGY

12 Pulse Frequency Converter

THD

PWM

TRANSFORMER

DC

PWM

EMC FILTER SPECIAL CABLE

PWM

PWM

STEALTH

SINE WAVE IS NOISE FREE, NO EMI

PWM CREATES A LOT OF EMI AND ACOUSTIC SWITCHING NOISE
THE DIFFERENCE:

LEAN DRIVE -PATENTED-

SWB

NEVER STOPS

0 1 FAILURES

3 0 YEARS

COST

COMPLEX PWM DRIVE

SWB

OFF-HIRE

5 0 FAILURES

COST

See our animated film at www.STADT.no
DISCOVER THE POWER OF SIMPLICITY

ELIMINATED:

- POWER DISTURBANCE THD ON GRID
- HARMONIC FILTERS
- 12 P - 24 P TRANSFORMER
- NOISE (PWM>EMC)
- EXPLOSION RISK (CAPACITORS)
- 80.000 COMPONENTS
- COOLING SYSTEMS
- 5-6% WASTED HEAT
- COMPLEXITY

= LESS DOWNTIME

MORE:

+ REDUNDANCY IN DRIVE
+ STEALTH
+ HMS AND COMFORT (SILENCE)
+ REDUNDANCY, ALSO IN AC PROPULSION MOTORS
+ POWER TO PROPELLER

= BETTER PERFORMANCE

STADT STEALTH LEAN PROPULSION®
COMPLEX PWM DRIVES (for comparison)

Can never be STEALTH or Noise-Free
STADT LEAN PROPULSION® REFERENCES

SAAB AB - Sweden
Naval ship

THOR Magni, Modi, Frigg, Freyja
SSV operated by PGS

Sanco Spirit
SRV operated by PGS

Sanco Star
SRV operated by PGS

THOR Magni, Modi, Frigg, Freyja
SSV operated by PGS

Econuri
Incheon Port Authority Guide Ship
Samsung Heavy Industries
150 MW INSTALLED POWER

SK Arctik, SK Atomik, SK Kinetik, SK Technik, SC Winter, SC Bongkot, SK Dynamik, Warami
AHTSV NCA80E, Nam Cheong

TOPAZ Master
TOPAZ Mariner
NCA80E for Topaz Marine

White Rabbit
Trimaran yacht 83x20m
Echo Yard Australia

Ocean Fortune
Ocean Mermaid
SSV - Vestland Offshore

Seihav
WELL-BOAT
Lerøy Seafood

Meløyfjord, Voldnes, Stokke Senior, Harto
Purse Seiners
WHY WE USE CPP - CONTROLLABLE PITCH PROPELLER

THE PATENTED STADT LEAN DRIVE COMBINES PITCH AND RPM-CONTROL

- Significantly improved overall efficiency at varying load and/or varying speed conditions
- Better manoeuvrability (acceleration, breaking, crash stop)
- Better performance at reversing and in DP
- Better operational conditions for gear, shaft, and bearings, especially at low speed
- Forgiving for design errors
- Each blade may be changed independently if damaged, at sea
- Future-proof with regard to changes of use of the vessel, slow steaming, extensions, etc.
- Possibility for full feathering position, which is saving fuel when only running one propeller
Significantly improved overall efficiency at varying load and/or varying speed conditions

Better manoeuvrability (acceleration, breaking, crash stop)

Better performance at reversing and in DP

Better operational conditions for gear, shaft, and bearings, especially at low speed

Forgiving for design errors

Each blade may be changed independently if damaged, at sea

Future-proof with regard to changes of use of the vessel, slow steaming, extensions, etc.

Possibility for full feathering position, which is saving fuel when only running one propeller

WHY WE USE CPP - CONTROLLABLE PITCH PROPELLER

STADT HYBRID

LEAN PROPULSION

CODLAG optionally
Twin screw PTI, CP
- 4 generators
- 4 electric motors
- 2 main switchboards

Triple screw, CP
- 4 generators
- 3 electric motors
- 2 main switchboards

Triple screw (2 Azipulls), CP
- 6 generators
- 3 electric motors
- 1 main switchboard with Bus-Tie
BATTERY OR FUEL CELL OPTIONS AVAILABLE IN ALL CONFIGURATIONS

**Single screw, CP**
- 2 diesel generators
- 1 gas turbine generator
- 2 electric motors
- 2 main switchboards

**Twin screw, CP - Hybrid**
- 2 generators
- 2 main engines
- 2 electric motors
- 2 main switchboards

**Twin screw (Azimuth or Voith), CP**
- 4 generators
- 2 electric motors
- 2 main switchboards

CODLAG is also an option
STADT - YOUR SYSTEM INTEGRATOR

LET US DESIGN YOUR NEW SUSTAINABLE PROPULSION SOLUTION
THE STADT SCOPE

Built according to MIL-STD-901 standard, we offer a full product range as listed below.

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

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

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

STADT AC motors, a broad range.

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
The STADT Group was founded by Hallvard L. Slettevoll in 1985. We are located in the new and modern STADT Maritime Center in Gjerdsvika harbour.

For many years STADT 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, bringing 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.

The Lean Drive was patented in 2008, and launched to the first ship applications the same year. The new drive technology has been awarded several times for its unique characteristics, and many ships are now sailing with the Lean Propulsion® technology all over the world.
LEAN BRINGS YOU

+ SAFETY & RELIABILITY
+ VERY LONG LIFETIME
+ STEALTH & HSE
+ MORE CARGO CAPACITY
+ LESS EMISSION AND FUEL
+ COST EFFICIENCY

We are member of
NORWEGIAN DEFENCE
AND SECURITY INDUSTRIES
ASSOCIATION

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