

Paradigm's all electric e-Winch® technology is built upon the extensive smart conveyance product range and delivers the much-needed breakthrough in operational safety, winch performance and environmental impact reduction demanded in today's low-carbon operations.

The **E35 Double Drum e-Winch®** system consists of a containerized winch unit designed to optimize LWI operations with excellent reliability, a compact footprint, and outstanding performance covering the range of open hole and cased hole operations.



The e-Winch® system uses the latest design in compact high-power inverters and permanent magnet motors. Sophisticated drive control software allows for precise and smooth control of the liquid cooled high torque electric motors. The direct electric drive system delivers the best winch control and automation available in the market today, providing rapid responses for fast stopping capability, instant torque delivery for fast acceleration and jarring, and ultra-slow stable logging speeds.

The software affords a high degree of automation and safety functionality by operator defined parameters, to prevent overpulls, pull-offs at surface or other unsafe situations.

### Applications

- Efficient, continuous wireline operations
- Open hole logging services
- Cased hole logging services

### Benefits

- Minimized crew requirements
- Ultra-slow logging and fast jarring
- Unmatched performance
- Energy efficient, no hydraulic system losses
- No emissions, low noise
- Low cost of operation
- Maintenance free and high availability

### Features

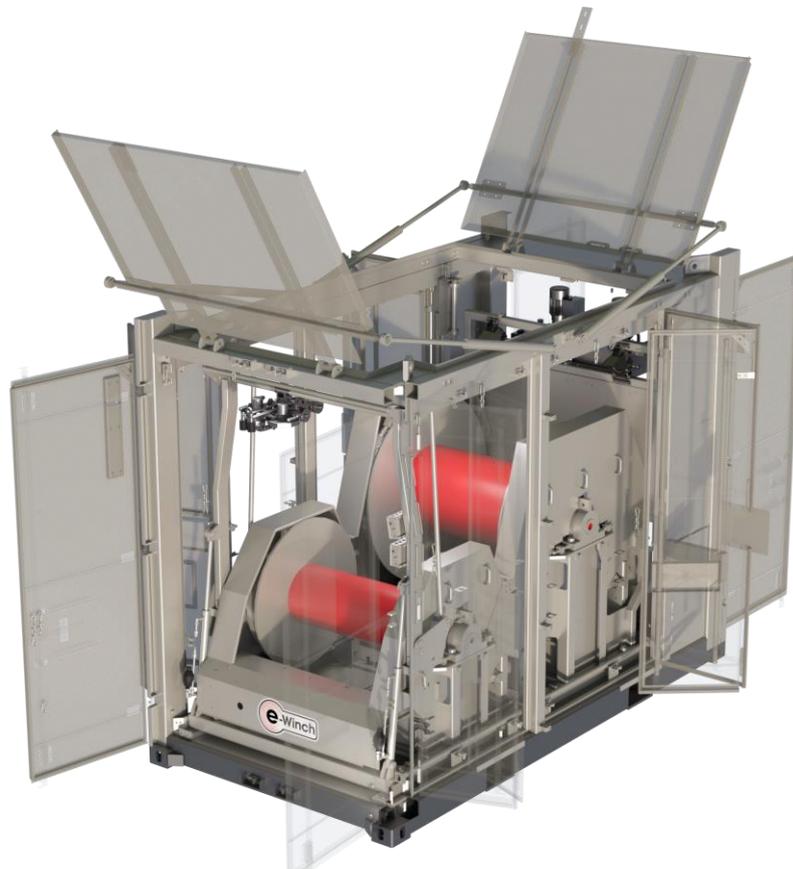
- Plug-and-Play Control & Monitoring system
- Standard joystick control
- Electronic depth, tension and speed visualization
- Rig safe certified drive systems
- Advanced safety functionality

### Directives & Certifications

- Machinery directive 2006/42/EC
- ATEX directive 2014/34/EU
- Electromagnetic compatibility 2014/30/EU
- DNVGL Offshore lifting
- NORSOK

The **E35 Double Drum e-Winch®** design is based on the latest standard in electric drive technology. Electric power from grid supply or a generator is directly converted into winch motion by servo motor and inverter technology. A liquid cooled electric motor drives the winch drums through a planetary gearbox, with a roller chain. The electric motor provides a precise control of speed, torque, and acceleration, either software controlled or by the operator. On the drum a band brake system is used as a parking brake. This band brake is fail-safe spring activated and electro-hydraulic released.

The levelwind system is a software assisted feature which provides a controlled manner of wire spooling. The level wind is driven by a servomotor, lateral movement is provided by a maintenance free high strength timing belt. The cooling system pump circulates the cooling liquid through the drive electronics cold plate, servomotor, brake resistor and fan cooled radiator to provide cooling in the harshest environments.

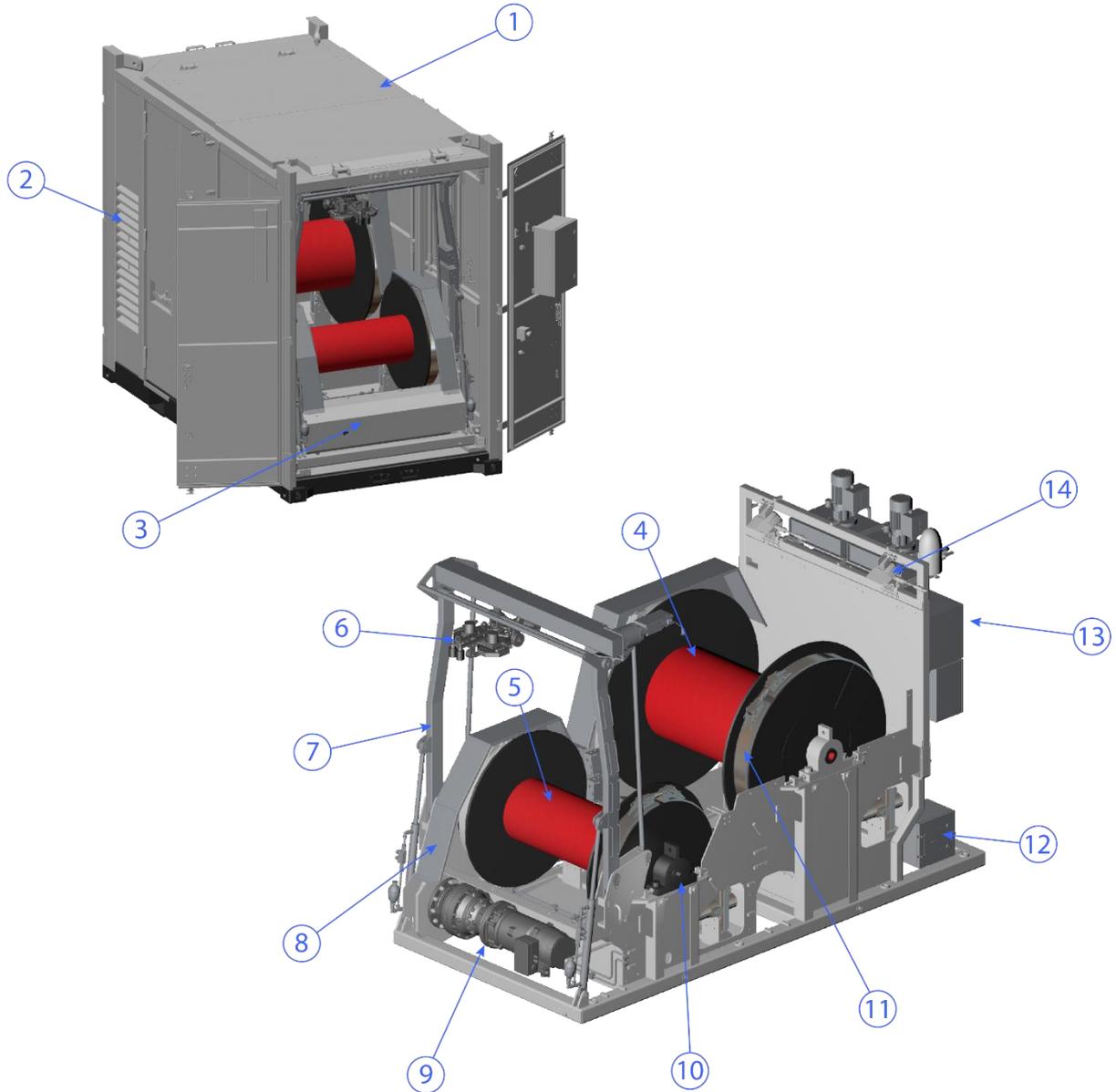


The unit is a single lift winch unit and has a double drum winch arrangement with easy exchangeable drums. The unit is also compatible with NOV Elmar ASEP style winch drums. Activated by hydraulic cylinders, the roof opens completely to allow drum exchange. An optional state-of-the-art hands-off drum exchange system can be included for increased safety and efficiency during offshore drum changeouts.

Electronic depth and tension are measured with the PM08, a straight-through measuring head with 2 independent 8"/2ft measuring wheels and an integral 3-wheel tension device.

The Control & Monitoring System allows the winch to be controlled either from a local control panel, a control chair in a control room, a portable winch control panel or a handheld remote control allowing optimal flexibility in terms of setup.

### E35 e-Winch® Module



### Main Components

1	Offshore unit container	8	Protection covers
2	Integrated electric power unit	9	Drum motor and gearbox
3	Winch module	10	Slipping adapter preparation
4	PD15 or PD18 open hole drum	11	Brake band
5	PD10 cased hole drum	12	Brake resistor
6	PM08 measuring head with redundant D/T system	13	Main power and electrical cabinets
7	Hydraulic level wind	14	Cameras

### Control & Monitoring System



### Main Components

1	E35 Double Drum e-Winch Module
2	Central Distribution Box
3	Operator Control Chair
4	Local control station (Zone 1)
5	Operator Control Panel
6	Handheld Remote Control

Paradigm's Control & Monitoring System allows the E35 Double Drum e-Winch® to be controlled either locally by a local control station or a handheld remote control and alternatively from a control chair in the control room or with a portable winch control panel. This allows maximum flexibility in terms of the control setup.

The Control & Monitoring System is also designed to be able to control multiple winches from a single control chair, increasing efficiency by facilitating simultaneous (offline) job preparation and (online) winch and providing redundancy.

In the above setup, a key element is the Central Distribution Box, which is mounted on deck close to the winch(es). All winch units are connected in a plug-and-play configuration and switching between units for operation is done without physically (dis)connecting.

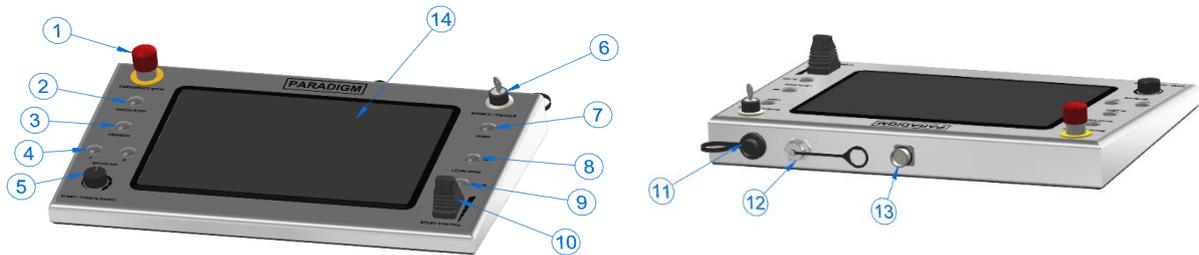
### Operator Control Chair



### Main Components

1	Emergency stop	7	Levelwind up / down
2	Winch stop	8	Horn
3	Cruise control trigger	9	Joystick for speed
4	Winch speed range setting	10	Mouse ball and buttons
5	Intercom talk button	11	Main winch enable / disable key
6	Spooler left / right (automated spooling override)		

### Operator Control Panel



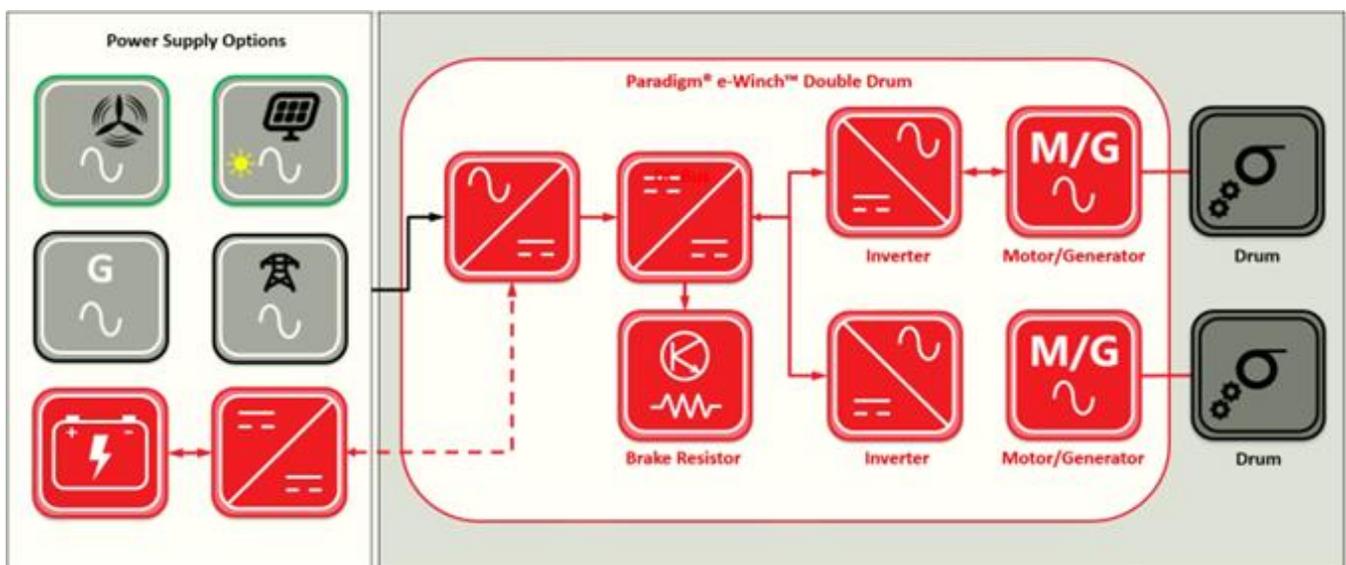
### Main components

1	Emergency stop
2	Winch stop
3	Cruise control trigger
4	Spooler left / right (automated spooling override)
5	Winch speed range setting
6	Enable / Release brake key switch
7	Horn
8	Levelwind Up
9	Levelwind Down
10	Joystick for winch speed and direction control
11	USB-A Plug
12	DisplayPort connection
13	Remote control multi connector
14	15,6" winch control panel touchscreen

The e-Winch® system power supply can either be connected to the grid or a generator set. The power supply converts the AC supply to a DC voltage on the DC bus. The motor inverter connected to the common DC-bus converts the DC voltage to a controlled AC voltage and current to control the speed and torque of the motor driving the drum.

When the winch is running in hole, decelerating, or stopping the motor acts as a brake generating power and feeding this brake power back to the drive system. This power is destroyed in a brake resistor or recovered. Energy recovery systems will be available on future versions of the direct electric winch drive system. This will maximize the energy efficiency of direct electric winch drive system.

### e-Winch® Direct Electric Drive System Layout for Double Drum.



### Optional Hardware

- Handheld radio remote control for rig-up
- Alternative planetary gear ratio
- Rig connection cable ordered to length
- Spare drum and chain
- Client specific paint system and colour
- Lifting Sling set
- Slick-E-Line® integration and hardware
- Slick-O-Line® integration and hardware
- ParaSheave™ w/ Depth & Tension
- Lower sheave
- Ambient temperature options: desert, arctic
- ATEX/IECEx Zone 1 certified drive system
- ATEX/IECEx Zone 2 certified drive system
- Alternative supply voltages
- Well control functions
- Well control pressure sensors
- Portable diesel genset
- Solar panel
- Battery pack

Nominal Specifications – Open Hole / Cased Hole		
	Metric	Imperial
<b>Electrical characteristics</b>		
Rated Power	75 kW	
Electrical connection	380 – 480 V, 50 – 60 Hz, 125 A, 3 phases, 4 wires	
<b>Mechanical characteristics</b>		
Structural design acc.	DNVGL-ST-E271 / ISO 10855	
Noise level	< 75 dB(A) @ 1 m	< 75 dB(A) @ 3 ft
Corrosion protection	Hempel paint system, ISO 12944 C5-M	
Topcoat colour	Grey RAL 7030	
<b>Dimensions &amp; weights</b>		
Dimensions (W x L X H)	3,820 x 2,000 x 2,985 mm	12.56 x 6.58 x 9.82 ft
Forklift pocket size	300 x 150 mm	12.0 x 6.0 inch
Weight (without drums and wire)	10.000 kg	22.045 lbs
Maximum container rating	20.000 kg	44.095 lbs
<b>Environmental limitations</b>		
Operating temperature range	-20 to +40° C	-4 to +104° F
Humidity	96% at +40° C	96% at +104° F
<b>Winch performance</b>		
<b>Drum type (Rear drum position)</b>	<b>PD15</b>	
Drum outer diameter	1400 mm	55.12 inch
Drum core diameter	550 mm	21.65 inch
Drum width	1054 mm	41.50 inch
Drum weight	1620 kg	3570 lbs
Maximum line speed at OD	105 m/min	345 ft/min
Maximum line speed at core	48 m/min	158 ft/min
Maximum line tension at OD	3,450 kg (6,800 kg) *	7,606 lbs (14,991 lbs) *
Maximum line tension at core	7,700 kg (14,950 kg) *	16,976 lbs (32,959 lbs) *
Minimum stable speed at OD	< 0.1 m/min	0.33 ft/min
Wire capacity 7/16" Wireline	11,700 m	38,386 ft
Wire capacity 15/32" Wireline	10,400 m	34,120 ft
<b>Drum type (Front drum position)</b>	<b>PD10</b>	
Drum outer diameter	1016 mm	40.00 inch
Drum core diameter	400 mm	15.75 inch
Drum width	1054 mm	41.50 inch
Drum weight	1200 kg	2645 lbs
Maximum line speed at OD	183 m/min	443 ft/min
Maximum line speed at core	70 m/min	210 ft/min
Maximum line tension at OD	3450 kg (6,100 kg) **	7,605 lbs (13,448 lbs) **
Maximum line tension at core	8800 kg (15,300 kg) **	19,400 lbs (33,730 lbs) **
Minimum stable speed at OD	0.15 m/min	0.49 ft/min
Wire capacity 5/16" Wireline	11,500 m	37,730 ft
*Speed ranges are adaptable, noting there is a trade-off between maximum speed and maximum tension.		
**Maximum line tension performance in optional boost mode (drive system limits).		
All products, product specifications and data are subject to change without notice, to improve design, reliability, functionality or otherwise.		

The e-Winch® system can run at a reduced power supply. With a reduced power supply the e-Winch® system is still capable to reach maximum line tension at a reduced line speed or the maximum line speed at a reduced line tension. Depending on the power supply available the current/power limitation can be set in the e-Winch® machine control software. The e-Winch® system can work with variable grid voltage from 380VAC up to 480VAC at 50 or 60hz. Depending on the available capacity it can be set between 16A and 125A.

Reduced power supply				
Input current at 400 V / 50 Hz	125 A	63 A	32 A	16 A
Power at the drum	70 kW	37 kW	19 kW	9 kW
Winch performance				
Drum type	PD15			
Maximum line speed at avg. diameter*	76m/min (250 ft/min)			
Line tension avg. diameter* at max. line speed	5,110 kg 11,266 lbs	2,580 kg 5,688 lbs	1,310 kg 2,888 lbs	655 kg 1,444bs
Maximum nominal line tension at avg. diameter*	5,600 kg (12,346 lbs)			
Line speed avg. diameter* at max. line tension	82 m/min 269 ft/min	41 m/min 135 ft/min	21 m/min 69 ft/min	10 m/min 33 ft/min
Drum type	PD10			
Maximum line speed at avg. diameter*	100 m/min (328 ft/min)			
Line tension avg. diameter* at max. line speed	3,880 kg 8,554 lbs	1,960 kg 4,321 lbs	990 kg 2,183 lbs	500 kg 1,102 lbs
Maximum line tension at avg. diameter*	4,320 kg (9,524 lbs)			
Line speed avg. diameter* at max. line tension	106 m/min 348 ft/min	53 m/min 174 ft/min	27 m/min 89 ft/min	14 m/min 46 ft/min
*Average diameter is considered the position on the drum at the average between core and OD.				

Paradigm e-Winch® software is part of Paradigm's well intervention software suite for intelligent conveyance. The basic e-Winch® software functionality can be extended with optional features and functions. These extra features and functions can be enabled with specific software licences and additional software products.

### **Basic control, visualization, safety and data recording functions.**

- Depth, Tension and Speed Visualisation
- Job & Run data recording
- e-Winch® system data recording
- Configurable system alarms
- Brake test
- Level wind control
- Sound alarm
- Shutdown alarm
- Backup Mode
- Drums & Cables Database
- Manual Control
- Power supply settings

### **Optional safety functions.**

- Tension and speed limits
- Differential tension safety
- Well section speed limits
- Dynamic braking

### **Optional control functions.**

- Rig up radio remote
- Constant speed and cruise control
- Constant tension
- Automated Jarring
- Boost Power
- Stuffing Box Pressure Monitoring & Control
- Well Pressure Monitoring & PCE Control

### **Optional data recording, visualization, connection and integration functions.**

- Third party logging system
- ParaView™ live data trending
- Fieldbus connectivity (customer system)
- Remote machine access
- Satellite Communication

### **Optional software products.**

- ParaLife™ Line management
- ParaRun™
- Ai-Winch™ Autonomous Software
- Winch Simulator
- Slick-E-Line® integration
- ParaChart™
- ParaView™

Drive System - Technology Comparison		
	Hydraulic driven <b>Diesel</b>	e-Winch® <b>Electric</b>
<b>Performance</b>		
Installed power	54 kW	75 kW
Machine efficiency	65 %	85 %
Power at the drum	35 kW	70 kW
Energy supply efficiency	30 % (diesel engine)	60 % (grid supply)
Acceleration	1 m/s <sup>2</sup>	3 m/s <sup>2</sup>
Speed control	+/- 1 m/min	+/- 0.01 m/min
Noise (at the operator position)	<82 dB (A)	<75 dB (A)
Automatic jarring and logging	✘	✓
Constant Speed with Cruise Control	✘	✓
Indoor Unventilated Operation (shop spooling)	✘	✓
Advanced Tamperproof Safety & Data Recording	✘	✓
Energy Recovery System (RIH & Deceleration)	✘	✓
Energy consumption on demand	✘	✓
Full Remote Control	✘	✓
Reduced CO <sub>2</sub> emissions	✘	✓
Reduced Daily Running Costs	✘	✓
Reduced Yearly Maintenance Costs	✘	✓
Guaranteed Zero Line Breakage	✘	✓
Increased Power at Drum	✘	✓
Improved Overall Efficiency	✘	✓
Lower Noise Pollution	✘	✓
<b>Cost of Ownership (Maintenance)</b>		
Fluid level checks	Daily	Daily
Exhaust gas cooler cleaning	Every 300 hours	Never
Exhaust flame arrester cleaning	Every 300 hours	Never
Exhaust spark arrester cleaning	Every 300 hours	Never
Air, fuel, oil filters change	Every 300 hours	Never
V-belt change	Yearly	Never
Air inlet safety valve service and calibration	Yearly	Never
Pneumatic air system service	Every 600 hours	Never
Diesel engine service (valves, fuel pump)	Every 600 hours	Never
System sensor calibration	Yearly	Yearly
Coolant pump service	Yearly	Yearly
Electrical System Check (CompEx or equivalent)	Yearly	Yearly
Yearly maintenance cost (Diesel engine, Zone 2 exhaust kit, hydraulic system)	\$ 15.000,00	\$ 0,00
<b>Environmental Emissions &amp; Impact<sup>#</sup></b>		
Direct machine exhaust CO <sub>2</sub> emissions (nominal)	20 kg/hr	0 kg/hr
Direct machine exhaust CO <sub>2</sub> emissions (per 8 year/5000 hour asset operating life)	100000 kg	0 kg
<sup>#</sup> Exhaust gas emissions		