

ENVIROS HONG KONG LTD
Room A, 18/F., Chun Wo Commercial Centre,
23-29 Wing Wo Street,
Central,
Hong Kong
Attn : Ms Ip
Fax : 2815-3377

Your Reference / Your Letter

Our Reference
QACM-050/cc

Date
24 February, 1999

QUOTATION NO. QACM - 050 / CC

Item (1)

One (1) unit Brandnew Atlas Copco Silenced Type Generator

Model : QAS 108 Pd
Rated speed : 1500 r/min
Rated frequency : 50 Hz
Rated continuous apparent power : 100 kVA
Rated power factor : 0.80
Rated voltage : 400 V
Rated current : 145 A
Engine : PERKINS 1006-TG2
Sound power level acc to EEC : 95 dB(A)
84/533/EC

Unit Price..... HK\$160,000.00

Item (2)

One (1) unit Brandnew Atlas Copco Pneumatic Breaker

Model : TEX 32PS
Weight : 34 kg
Air requirement : 35 l/s
Length : 746 mm
Impact rate : 1200 blows/min
Shank size : 32x160 mm

Unit Price..... HK\$5,000.00

ENVIROS HK LTD				
Name	PL note	PL discuss	PL action	Date
LYL	<input checked="" type="checkbox"/>			24.2.99
YVL				24.2.99
Copy				
CAN/File				

Construction & Mining Technique

Atlas Copco China/Hong Kong Ltd

Postal Address
P O Box 69407
Kwun Tong,
Hong Kong

Visitors Address
Unit 1504-1507,
Kwun Tong Harbour Plaza,
182 Wai Yip Street,
Kwun Tong, Kowloon,
Hong Kong

Main Office
Tel.: 2797 6600
Fax: 2172 4248
2142 6250 (F&A)

Service
Tel.: 2488 0103
Fax: 2488 9863

Spare Parts Centre
Tel.: 2483 2747
Fax: 2488 0516

852 2172 4248

Atlas Copco Generators

QAS 14-338

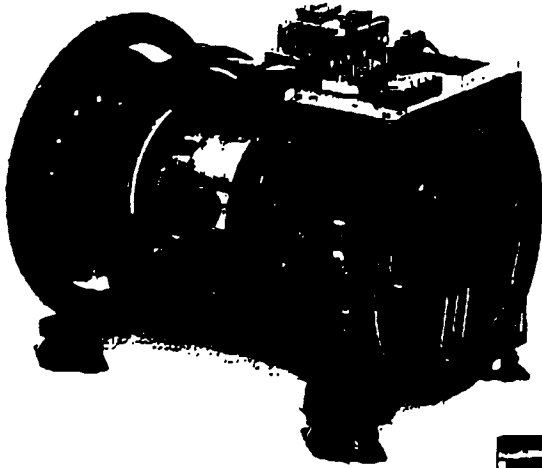
13-360 kVA

50/60 Hz



Atlas Copco

Instant electric power.



Operation in all conditions

QAS generators are fitted with a sturdy, weatherproof canopy mounted on a heavy-duty skid base. This means that they can be installed anywhere, requiring no special foundations.

The foam lining of the doors attenuates noise to a level that fully complies with EC regulations, meaning that the unit can be operated at night or close to such noise sensitive locations as hospitals.

Economy and easy starting. Quick response and stable power

The impressively reliable diesel engine is built to deliver fuel economy and ease of start-up. The synchronous brushless alternator responds rapidly to load fluctuations, and requires minimal maintenance.

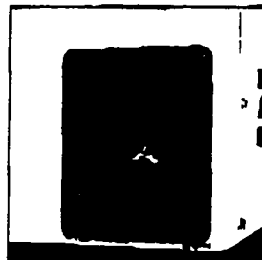


Generators that will work for as long as you want

The reliable Detroit diesel engine on QAS168-338 is monitored by an Electronic Control Module (ECM) for top performance, optimum fuel economy and full diagnostics.

Continuous performance

The capacity of the fuel tank allows for full, uninterrupted shift work - even when the unit is run under full load. The lockable fuel cap is positioned to avoid damage, yet can be readily reached.



The engine can be connected to a separate fuel tank. To operate your generator during double around-the-clock shifts, a three-way valve (standard on QAS108-338) facilitates fuel supply from an external fuel tank.

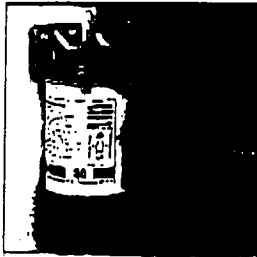


The engine oil can be easily removed by means of a sturdy drain pump (standard on QAS168-338).

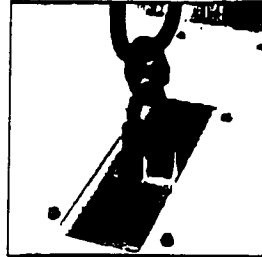
A wide opening in the base frame permits quick and clean drainage of both engine oil and cooling liquid.

852 2172 4248

Whenever, wherever you need it

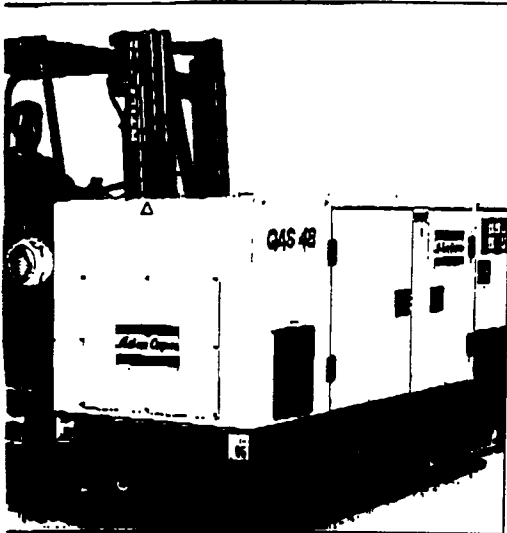


A big capacity fuel filter/water separator assures trouble free operation by protecting the fuel injection system against solid and liquid impurities.



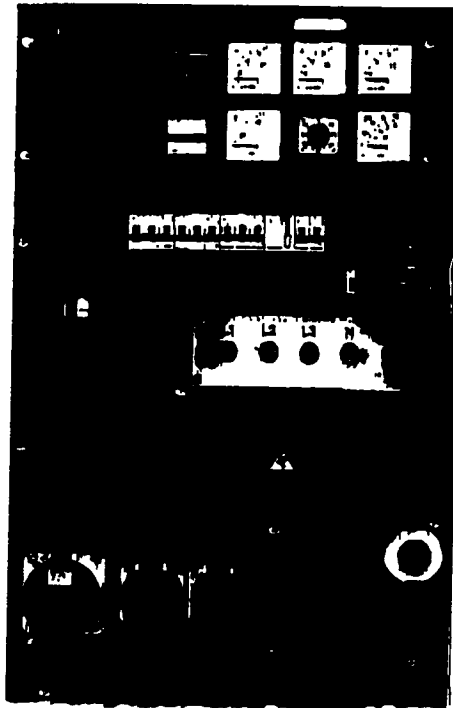
Handling made easy

A sturdy lifting rod means that the unit can easily be lifted by a crane.



Two slots on each side of the machine have been incorporated so that the generator can safely be transported by a forklift truck.

Designed with safety in mind

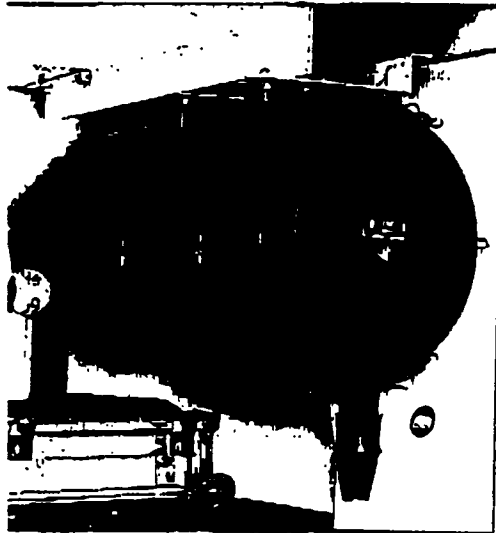


The comprehensive monitoring system and instrument displays are shielded by a transparent covering, permitting supervision of all key functions at a glance without having to open the canopy.

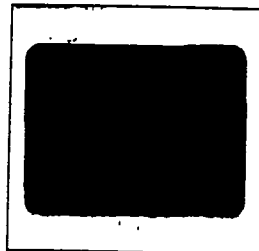
The instrument panel is effectively protected against excessive humid environmental air. The instrument panel on units with the Detroit diesel engine includes a connection for the Electronic Control Module (ECM).

Full protection against accidents: the design of the quick fix electrical connections eliminates the risk of accidental contact with the terminals. Sockets are available as an option.

The unit is fitted with a 4-pole circuit breaker - which opens when the engine is stopped - and an earth leakage relay. The emergency stop button is located within easy reach, and its activation does not require the canopy to be opened.



A two-stage air intake filter with safety cartridge protects the engine against dust and solid particles under all circumstances.



Safeguarded against unauthorised use

The door handles on these units are both lockable and recessed - minimising the potential for accidental damage.

Principal data

Performance data (1)

Type		QAS 14	QAS 18	QAS 28	QAS 38
Rated speed at 50/60 Hz	r/min	1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800
Rated Power Factor (lagging)		0.80	0.80	0.80	0.80
Rated continuous apparent power at 50/60 Hz	kVA	13 / 16	17 / 21	25 / 31	34 / 43
Rated standby power at 50/60 Hz	kVA	14 / 18	19 / 23	28 / 34	38 / 47
Rated voltage, line-to-line at 50/60 Hz	V	400 / 480	400 / 480	400 / 480	400 / 480
Rated current	A	19	24	36	49
Fuel autonomy at full load at 50/60 Hz	h	26	21	16 / 14	13 / 11
Maximum sound power level complying with ISO 84/536/EC at 50 Hz	LWA	90	90	95	95
Maximum sound pressure at 50/60 Hz	dB(A)	62.6 / -	63.3 / -	68.5 / -	67.5 / -
Capacity of fuel tank	l	85	85	100	100

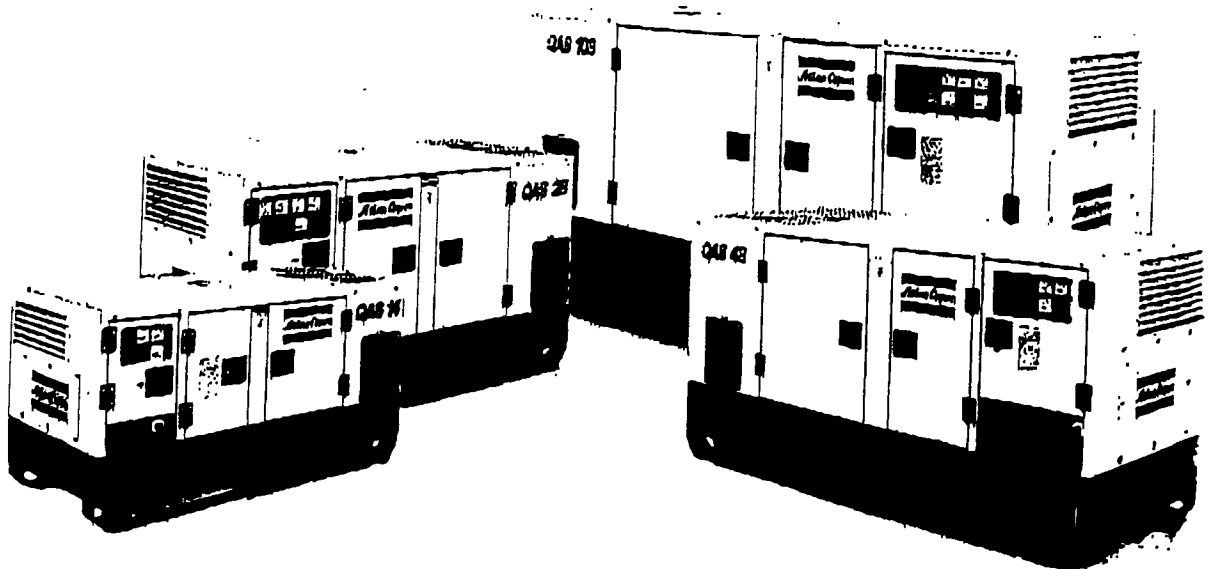
Design data

ALTERNATOR

Insulation - stator	class	H	H	H	H
- rotor	class	H	H	H	H
Number of phases		3	3	3	3
Number of leads		12	12	12	12
ENGINE					
Make		YANMAR	YANMAR	YANMAR	YANMAR
Model		3TN88-ACG	4TN88-ACG	3TN100-ACG	4TN100-ACG
Rated net output at 50/60 Hz	kW	12.8 / 15.4	16.4 / 19.7	23.9 / 28.5	31.7 / 38
Coolant		liquid	liquid	liquid	liquid
Number of cylinders		3	4	3	4
Bore	mm	88	88	100	100
Stroke	mm	96	96	110	110
Swept volume	l	1.642	2.189	2.591	3.455

Unit (2)

Dimensions : Length	mm	1860	1860	2080	2080
Width	mm	811	811	951	951
Height	mm	957	957	1157	1157
Weight (dry)	kg	670	714	990	1050
Weight (ready-to-operate)	kg	749	793	1092	1166

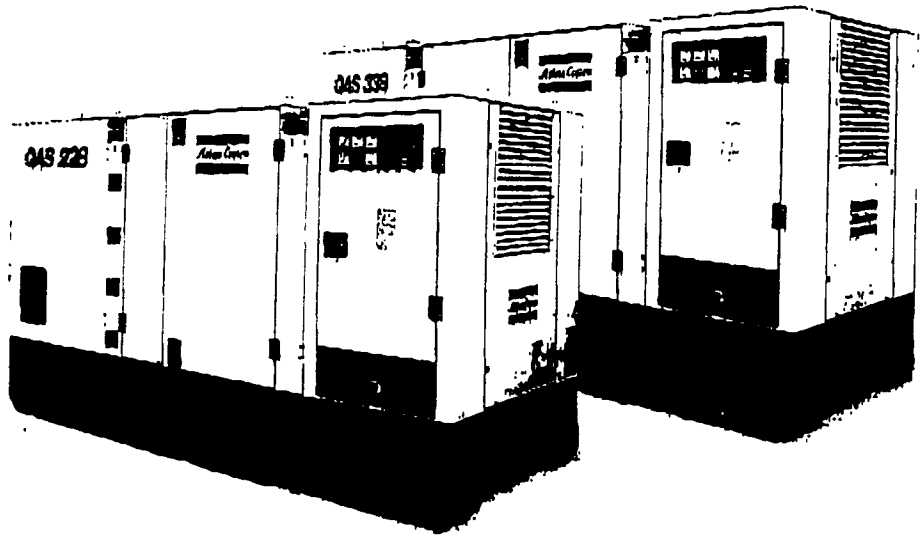


QAS 48	QAS 78	QAS 108	QAS 138	QAS 168	QAS 228	QAS 278	QAS 338
1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800	1500 / 1800
0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
45 / 53	69 / 82	100 / 124	125 / 150	150 / 180	200 / 240	250 / 300	300 / 360
50 / 58	76 / 90	110 / 136	138 / 165	165 / 198	220 / 264	275 / 330	330 / 396
400 / 480	400 / 480	400 / 480	400 / 480	400 / 480	400 / 480	400 / 480	400 / 480
65	100	145	180	216	290	360	433
16 / 13.5	11 / 9	13 / 11	11 / 8.8	17 / 14	12 / 10	11 / 9	9 / 7.5
95	95	95	97	97	97	97	97
68.1 / 69.6	66 / 69.9	67.6 / 69.5	70.2 / 72.6	70.3 / 72.6	69.6 / 72.5	70.1 / 72.5	71 / 73
175	175	310	310	530	530	530	530

Q	H	H	H	H	H	H	H
3	3	3	3	3	3	3	3
12	12	12	12	12	12	12	12

PERKINS	PERKINS	PERKINS	PERKINS	DETROIT DIESEL	DETROIT DIESEL	DETROIT DIESEL	DETROIT DIESEL
1004-G	1004-TG	1006-TG2	1006-TAG	S 50	S 50	S 60	S 60
42 / 47	65 / 84	91.5 / 107	110 / 130	132 / 156	174 / 204	216 / 253	261 / 310
liquid	liquid	liquid	liquid	liquid	liquid	liquid	liquid
4	4	6	6	4	4	6	6
100	100	100	100	130	130	130	130
127	127	127	127	160	160	160	160
3.990	3.990	5.990	5.990	8.500	8.500	12.700	12.700

2562	2562	3112	3112	3470	3470	3950	3950
1031	1031	1131	1131	1440	1440	1440	1440
1307	1307	1507	1507	2330	2330	2330	2330
1492	1492	1923	2103	3560	3630	4190	4280
1669	1669	2273	2383	4050	4150	4700	4800



1) Reference condition
 For engine performance to ISO 3046/1-1981
 Air inlet temperature from -18°C to 40°C
 Max. altitude above sea level: 1000 m

Rating definitions
 All units are designed to supply continuous electrical power at full load without limitation to the annual number of hours of operation and with a 10% load capacity during one hour per 12 hours.

2) Configuration D to ISO 8528-1: 1993 with
 baseframe, integrally mounted control gear, switchgear and auxiliaries, in enclosure.



ENVIROS HK LTD					
DATE	BY	PL. C. NO.	PL. C. ACTION	PL. C. ACTION	PL. C. ACTION
	VEL MAN				
DATE					
PL. C. NO.					
PL. C. ACTION					
PL. C. ACTION					



By: PPP

The China Engineers, Limited
信昌機器工程有限公司

Our Ref. No : 13/99089/NT
Messrs. : Enviros Hong Kong Ltd.

Date : 24 June 1999

Attn. : Mr. V. C. Lau / Ms. Marlene Ho

Fax No. : ~~2815 2221~~
2815 3377

ENVIROS HK LTD
24 JUN 1999
RECEIVED

Quotation

With reference to your inquiry, we are pleased to quote the budgetary price of the following items for your reference :

<u>Item</u>	<u>Model</u>	<u>Qty</u>	<u>Unit Price</u>	<u>Total Price</u>
1.	NEW CATERPILLAR D8R TRACK TYPE TRACTOR-BULLDOZER(305 HP) Attachments : a) ROPS Cab with Air-conditioner b) Semi-U Blade c) Single Shank Ripper	1	HK\$2,680,000	HK\$2,680,000
2.	NEW CATERPILLAR D6R TRACK TYPE TRACTOR-BULLDOZER(165 HP) Attachments : a) ROPS Cab with Air-conditioner b) Semi-U Blade	1	HK\$1,780,000	HK\$1,780,000
3.	NEW CATERPILLAR 928G WHEEL LOADER Attachments : a) ROPS Cab with Air-conditioner b) 2.2 cu.m. General Purpose Bucket with Cutting Edge	1	HK\$780,000	HK\$780,000
4.	NEW CATERPILLAR 966G WHEEL LOADER Attachments : a) ROPS Cab with Air-conditioner b) 3.8 cu.m. General Purpose Bucket with Cutting Edge	1	HK\$1,380,000	HK\$1,380,000

Grand Total : **HK\$6,620,000**

Page 1/2

NT/GY



**China
Engineers**



The China Engineers, Limited
信昌機器工程有限公司

Our Ref. No : 13/99089/NT
Messrs. : Enviros Hong Kong Ltd.

Date : 24 June 1999

The above equipment are typical earthmoving and construction equipment to be used in Hong Kong. With regard to the sound power level, the following is for reference only :

<u>Model</u>	<u>Operator*Sound Pressure Level per ISO6396 or 86/662/EEC</u>	<u>Spectator*Sound Level per SAE J88</u>
D8R	85 dB(A)	↔ 102 dB(A) @ 1.5 m
D6R	81 dB(A)	- not available -
928G	73 dB(A)	↔ 75 dB(A) @ 15 m
966G	75 dB(A)	- not available -

Remarks : All Caterpillar cabs meet OSHA and MSHA limits for operator and sound exposure with doors and windows closed (according to ANSI/SAE J1116 MAY90). For sound level data for spectator, there is no regulatory requirement and normally will not be published.

Meanwhile, should you have any queries, please feel free to contact the us on 2442 6729.

Terms and Conditions

- Manufacturer** : Item 1) Caterpillar Inc. (U.S.A.)
Item 2, 3 & 4) Shin Caterpillar Mitsubishi Ltd. (Japan)
- Pricing Term** : All prices are in H.K. Dollars and C.I.F. Hong Kong.
- Validity** : 30 days from the date of this quotation.
- Payment** : By 100% irrevocable L/C at sight basis against shipping documents.
- Delivery Time** : Ex-works in twelve (12) weeks after receipt of L/C.
- Service Condition** : a) Delivery service.
b) Periodic service at first 250 service meter hours.
- Warranty Condition** : 12 months standard warranty with unlimited hours.
- Remarks** : All prices are valid for customers in Guangdong, Guangxi, Hainan, Hunan, Jiangxi & Fujian Provinces only.

For and on behalf of
The China Engineers, Limited

.....
Sales Manager
Construction Equipment Division

TAX: 28153377

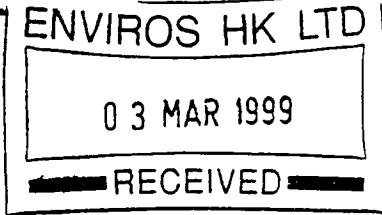
Dear Ms Li

Enclosed please find our brochure that can achieve a more level

of 98WBA!

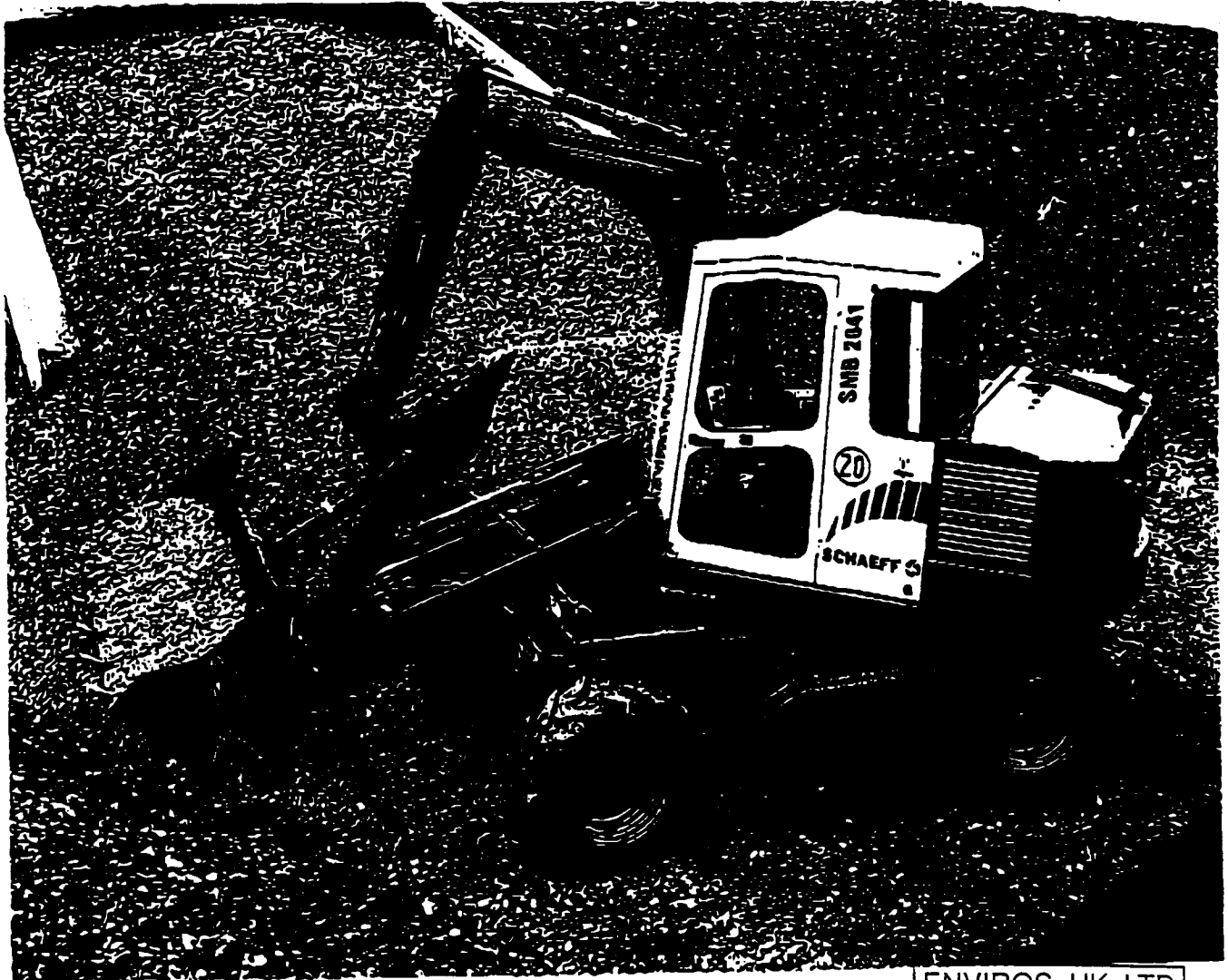
Frank Ong

EPC
90530030



SMB 2041

MOBILE EXCAVATOR-LOADER



ENVIROS HK LTD

Name	PL note	PL discuss	PL action	Date



The powerful all-round performer

Operating weight 8,5 t

Engine power 59 kW (80 HP)

Loader bucket capacities 0,85 - 1,1 m³

Excavator bucket capacities 65 - 200 l

SCHAEFF



Technical data

Engine
 Manufacturer Perkins
 Type 4-cylinder, diesel engine
 Combustion .. 4-stroke-cycle, direct fuel-injection
 Power rating acc. to ISO 9249 (DIN 70 020)
 at 2200 r.p.m. 59 kW (80 HP)
 Cooling system Water

Electrical system
 Nominal voltage 12 V
 Battery 12 V / 105 Ah / 450 A

Power transmission
 Hydrostatic drive with load limit control, i.e. draw bar pull and speed are automatically adjusted.
 4-wheel drive from reduction gear on front axle via cardan shaft to rear axle, full power shift forward and reverse.
 Infinitely variable speed control forward and reverse.
 2 speed ranges:
 "Low" 0 - 7.5 km/h
 "High" 0 - 20 km/h

Axles
 Front: Oscillating planetary final drive axle, slip-type differential, with integrated reduction gear.
 Oscillation 15 deg.
 Rear: Fixed planetary final drive axle.

Tires
 Standard 16/70-20 MPT 10 PR

Brakes
 Service brake: Hydro-servo brake system in front axle operates two oil-immersed multi-disc brakes, acting on all 4 wheels via cardan shaft.
 Auxiliary brake: Hydrostatic drive provides dynamic braking.
 Parking brake: Hydraulic spring-loaded brake.
 Excavator brake: Acts on front axle via lockable service brake.

Steering
 Hydraulic 4-wheel steering. Front and rear axle with integrated steering cylinder (stub axle steering).
 Steering angle front and rear axle 30 deg.

Hydraulic system
 Axial piston pump with load-sensing system for working and steering hydraulics. This system works independently from the hydrostatic drive.
 Pump capacity max. 156 l/min
 Working pressure 230 bar
 Gear pump on P.T.O. for all positioning functions.
 Pump capacity max. 42 l/min
 Working pressure 220 bar
 1 lift and 1 dump cylinder, double acting.
 Dump cylinder as cylinder with double end rod for quick loading and unloading. Two pilot-operated four-way control levers.

Swing drive
 Hydrostatic drive with integrated reduction gear, also provides dynamic braking. Additionally, automatic spring-loaded multi-disc brake as parking brake when the pilot control lever is in neutral position.
 Swing range 360 deg.
 Swing speed-uppercarriage 0 - 8 r.p.m.

Knickmatik®
 Parallel lateral adjustment at max. digging depth.
 Lateral adjustment to the right 505 mm
 Lateral adjustment to the left 730 mm

Operating data, standard equipment
 Operating weight acc. to ISO 6016 8500 kg
 Undercarriage/Loader:
 Parallel-guided lift frame with integrated mechanical quick-mount hitch.
 Total width 2200 mm
 Turning radius outside bucket edge
 in transport position 4785 mm
 Wheel base 2400 mm
 Tread width 1750 mm
 Ground clearance below cardan shaft .. 480 mm
 Lift capacity at ground level
 acc. to ISO 8313 52,900 N
 Ripping force acc. to ISO 8313 49,500 N
 Tipping load, straight acc. to ISO 8313 .. 3500 kg
 Lift capacity on forks acc. DIN 24 094
 resp. ISO 8313 over the total lift range .. 3500 kg
 Safety factor on level floor 1.25
 Distance to center of gravity 500 mm
 Uppercarriage/Excavator:
 Total length, bucket on ground 5800 mm
 Total height, travel position 3940 mm
 Support width / outrigger pads .. max. 2600 mm
 Uppercarriage tailswing 1450 mm
 Working cycle 180° 4570 mm
 Breakout force (DIN 24 086) 31,300 N
 Ripping force (DIN 24 086) 25,400 N

Cab
 Sound-insulated, rubber-mounted full-vision steel cab, ROPS (acc. to ISO 3471) and FOPS (acc. to ISO 3449) certified.
 Safety glass windows, pneumatic-spring supported front windshield - slidable under the cab roof. Hot water heat exchange with 3-stage blower and windshield defroster.
 Hydraulically cushioned comfort seat with armrest adjustment and longitudinal, height and inclination adjustments. Telescopic and inclination adjustments of steering column. Instrument panel with monitoring module. Working floodlights Halogen E-3.
 Noise emission ambient L_{WA} 95 dB (A)
 Noise emission cab L_{PA} 76 dB (A)
 Determined according to EEC-directive 86/662.

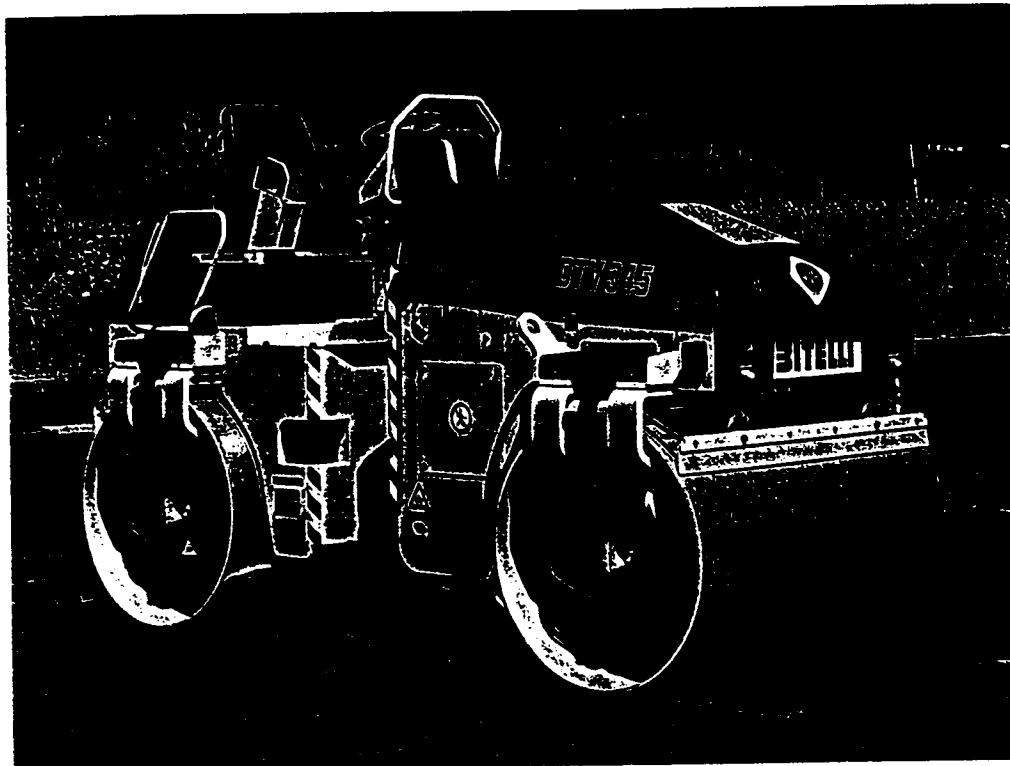
Fluid capacities
 Fuel tank 120 l
 Hydraulic system (includes tank) 190 l



BITELLI®

ELFO DTV 345

VIBRATORY TANDEM ROLLER - DOUBLE TRACTION
DOUBLE AND SINGLE VIBRATION



MAIN SPECIFICATION

Operating weight (CECE regulations)	4200 kg
Shipping weight	4000 kg
Weight per axle front/rear	16,8 kg/cm
Linear static load front/rear	16.8 kg/cm
Compaction width	1250 mm
Turning radius outside	4740 mm
inside	3440 mm
Articulation angle	± 28°
Oscillation angle	± 11°

TANKS CAPACITIES

Diesel fuel	65 l
Hydraulic oil	49 l
Water	210 l

DRIVE

Diesel engine	Deutz F3L 1011F
Output at 3000 rpm (DIN 6271)	33 kW (45 HP)
Transmission system	hydrostatic
Forward / reverse speed	0÷9 Km/h
Max gradeability with vibration	35%
without vibration	40%
Hydrostatic steering system	power steering

VIBRATION

Hydrostatic transmission	on both drums
	or on each drum separately
Frequency	2800 rpm - 46,7 Hz
Centrifugal force per drum	
low amplitude	2000 Kg - 19,6 kN
high amplitude	3300 Kg - 32 kN

NET HOURLY OUTPUT (Ph)

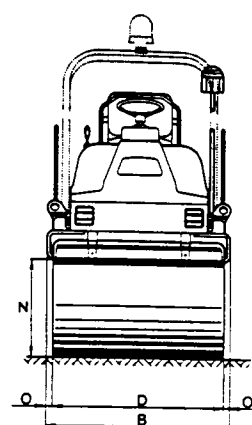
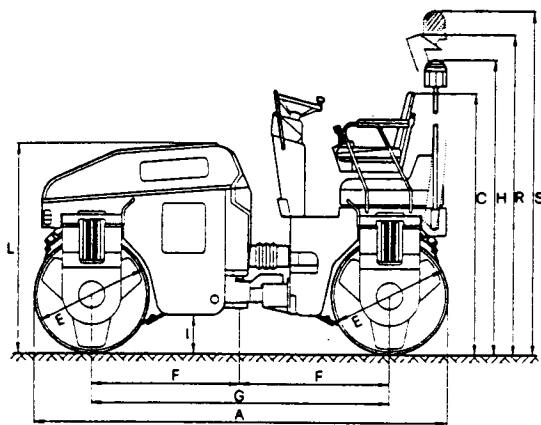
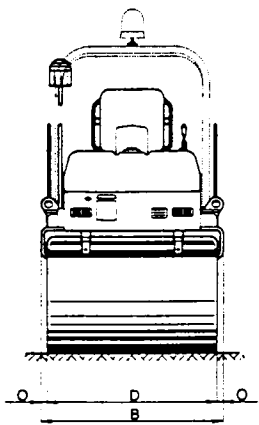
current utilisation

BITUMINOUS MIX (t/h) $Ph = \frac{F \cdot W \cdot S \cdot T \cdot G}{P}$									SUB-BASE (m ³ /h) $Ph = \frac{F \cdot W \cdot S \cdot T}{P}$								
N. of passes	Speed (km/h)	THICKNESS OF THE COMPACTED LAYER (cm)						Compacted area (sp.m/h)	N. of passes	Speed (km/h)	THICKNESS OF THE COMPACTED LAYER (cm)						Compacted area (sp.m/h)
		3	4	6	8	10	12				15	10	20	30	40	50	
2	4	103	138					1500	2	3	141	281					1406
	5	129	172					1875		4	187	375					1875
	6	155	207					2250		5	234	469					2344
4	4	52	69	103				750	4	3	70	141	211				703
	5	65	86	129				937		4	94	187	281				937
	6	78	103	155				1125		5	117	234	351				1172
6	4	34	46	69	92	115		500	6	3	47	94	141	187			469
	5	43	57	86	115	144		625		4	62	125	187	250			625
	6	52	69	103	138	172		750		5	78	156	234	312			781
8	4	26	34	52	69	86	116	375	8	3	35	70	106	141	176		352
	5	32	43	65	86	108	129	469		4	47	94	141	187	234		469
	6	39	52	78	103	129	155	562		5	59	117	176	234	293		566

F = Reduction factor assumes an overlap of 25% on bituminous mix (F = 0,6) and of 10% on sub-base (F = 0,75) and an effective working time of 50 min/h.

W = Drum width (m)
T = Layer thickness (m)
G = Bituminous mixes specific gravity equivalent to (2,3 tons/m³)

S = Working speed (m/h)
P Nr. of passes (to or fro)



ELFO DTV 345

Dim.	A	B	C	D	E	F	G	H	I	L	N	O	R	S
mm	2940	1340	1890	1250	850	1045	2090	2500	280	1540	700	45	2780	3000

FRAME: the central articulated frame consist of a front half-chassis housing the engine and the transmission system components and a rear half-chassis. Both parts support a vibrating driving drum.

The overall size of the machine side is remarkably reduced to facilitate finishing operations close to wall and obstacles.

ENGINE: diesel engine DEUTZ F3L 101 1F with double air and oil cooling system and electric starting. The engine drives directly the hydraulic steering pumps as well as the pumps for vibration. Through a particular device, it drives the translation pump.

SOUND PROOFING SYSTEM: sound proofing within the EU standard regulations (operator's seat within 85 dB(A)).

STEERING: a gear-type pump feeds the ORBITOL power assisted steering, controlled by the steering wheel, which actuates a double-acting cylinder. In case of pressure drop in the hydraulic system, the cylinder can be operated using the steering-wheel, since the ORBITOL acts as a hydraulic pump.

TRACTION DRIVE: both drums are driving. Total traction is obtained by means of a hydraulic differential that can be locked by a control from the driver's seat (on request). Hydrostatic transmission through a variable displacement pump feeding both the hydraulic motor and the final reduction gear assy placed on each drum. Smooth and gradual reverse and acceleration are possible thanks to an electric servo-assisted control system.

VIBRATING SYSTEM: the double amplitude vibrating system acts on both drums. Each drum can vibrate independently thanks to suitable arrangements. Transmission is obtained by a gear type pump. The hydraulic motors, placed on the side of each drum, are splined to the vibration shaft through a special shock absorber joint. The electrically controlled vibration device allows two possibilities: "automatic" and "continuous" mode. **AUTOMATIC:** the vibrating system is engaged automatically by a microswitch mechanically energized by a cam placed on the control lever for travelling. This device makes the driver's operation easy and the use of the vibration system more functional. For each reverse, when the lever reaches the "neutral" position, the vibrating system,

automatically stops to start again gradually when forward or reverse are inserted. **CONTINUOUS:** the vibrating system is working non-stop even with the lever in "neutral" position. The frame is insulated from vibrations thanks to a set of silent blocks.

HYDRAULIC SYSTEM: the translation hydrostatic transmission and the vibration hydraulic transmission are protected by a heat exchanger and by filters placed at the suction side of the pumps: the translation pump filter is fitted with a vacuum gauge.

BRAKING SYSTEM: Service Brake: hydrostatic system controlled by the forward / reverse lever with "stop" on central neutral position.

Safety and parking brake: mechanical negative multidisk brake that operates directly on the hydraulic motor shaft of each drum. Manual control by a push button. In case of a pressure drop in the hydraulic system, the brake is automatically applied.

WATER SPRINKLING SYSTEM: it provides water to pressurised nozzles on drums by an electric pump with filters and stainless steel pipes. Water can be supplied also by gravity. Water tank in linear polyethylene. A timer allows to adjust the quantity of water sprinkled on each drum.

DRIVER'S SEAT: comfortable sliding seat, allowing a great visibility on both sides of the machine, fitted with a pressure sensitive switch to indicate the operator's presence. Steering wheel with auxiliary knob. Instrument panel with ignition key, electric hourmeter and control lights for engine, light system, water sprinkling system, vibrating system. Lever for translating system, brakes and accelerator are very comfortable. Panel cover to protect against vandalism.

ELECTRIC SYSTEM: one 12V - 100 A.h battery. Complete lighting system for work and travel.

ON REQUEST

- ROPS protection
- DIFFERENTIAL LOCK

Rops protection is always required for CE conformity

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- Predict construction noise levels at NSRs, with a facade correction, in the absence of any mitigation measures.

Where noise assessment criteria are exceeded at NSRs, appropriate mitigation measures have been evaluated and recommended. A systematic approach to the evaluation of mitigation measures has been adopted, including consideration of the three levels of mitigation (and combinations of each level) described in *Table 4-4a*.

Table 4.4a Primary Construction Noise Mitigation Strategy

Mitigation	Description
Level One	Selection of quiet plant and working methods
Level Two	Construction of temporary noise barriers
Level Three	Reduction of plant teams

In general, noise barriers of 3 to 5 metres located on site boundaries between noisy construction activities and NSRs can give up to 5 dB(A) reduction from screening. Barriers in the form of site hoardings can achieve this level of reduction although care in the location of site access needs to be taken to ensure effectiveness of the barriers. Certain types of PME, such as generators and compressors, can be completely enclosed to give a total reduction in SWL of 10 dB(A) or more. Movable barriers that can be located close to noisy plant can also be very effective at screening NSRs from particular plant.

Some models of plant are quieter than the standard types listed in TM2. Quiet plant is defined as PME whose actual SWL is less than the value specified in the TM for the same piece of equipment. The benefits achieved in using quiet plant will depend on the Contractor's chosen methods of working. Examples of SWLs and Sound Pressure Levels (SPLs) at a reference distance for specific silenced PME that may be used in the construction of West Rail are given in *Table 4-4b*.

Choice of the number and types of construction plant is usually left to the Contractor, allowing flexibility in devising working methodologies. However, in combination with the selection of quiet plant, limiting plant numbers may be needed to provide further mitigation of construction noise levels at source.

Table 4.4b Listing of Quiet Plant

Powered Mechanical Equipment (PME)	Maximum SWL dB(A)	Equivalent TM2 CNP Reference
Bored Piling Rig	110	CNP 165
Breaker	108	CNP 024
Bulldozer	110	CNP 030
Concrete Pump	105	CNP 047
Dump Truck	110	CNP 067

Powered Mechanical Equipment (PME)	Maximum SWL dB(A)	Equivalent TM2 CNP Reference
Excavator	105	CNP 081
Generator	100	CNP 101
Generator (silenced)	100	CNP 103
Loader	105	CNP 081
Lorry	105	CNP 141
Poker Vibrator	110	CNP 170
Mobile Crane	105	CNP 048
Modern Breakers (mounted on demolition robot)	SPL at 7 m 89-91	
Modern Saw (power wire saw, or modern wall saw)	76-81	
Kick Ripper, Saw and lift method	78-80	
Bursting System	70-72	
Crusher (hand held or mounted on demolition robot, hydraulic)	67-69	
Pipe Jacking	60-65	
Non explosive chemical agent	60-65	

4.4.2 Operational Phase

4.4.2.1 Introduction

This specialist component of the assessment evaluates airborne noise impacts from the operation of West Rail and its associated facilities. Operational airborne noise impacts for West Rail derive from three potential sources:

- Airborne noise from passenger rolling stock on West Rail and train induced vibration in elevated structures re-radiated as noise;
- Maintenance activities at the depot and along railway tracks; and
- Fixed electrical and mechanical plant (including ventilation systems), which are likely to be the dominant sources of noise within the vicinity of passenger stations, traction substations and ventilation buildings.

4.4.2.2 Spatial Scope

The spatial scope of the operational noise assessment is defined by the distance from the sources of airborne noise at which the operational noise criteria described in *Section 3.2* are likely to be exceeded.