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HIGH PERFORMANCE DRY PUMPING

WITH INTELLIGENCE TO MATCH



BOC EDWARDS

INTEGRAL INTELLIGENCE

THE iQ DRY PUMPING SYSTEM IS A NEW MICROPROCESSOR CONTROLLED, MODULAR PACKAGE THAT PROVIDES UNPARALLELED CONTROL AND MONITORING FACILITIES...

With the proven Edwards' dry pumping mechanism at its heart, the iQ series has the addition of intelligent pump monitoring and control. Each iQ pumpset has integrated sensors which continuously monitor key system performance parameters and give advanced warning of problems.

The sensors measure:

- Motor power and current
- Exhaust gas back pressure
- Total and purge nitrogen flow
- Pump and motor temperatures

Additional sensors are available including:

- Oil level switch
- Water flow switch
- Exhaust gas temperature

The *iQ* pumpset parameters can be monitored and displayed through a variety of output devices including:

- Hand-held or panel mounted control module
- Local PC or lap-top computer
- OEM specified tool interface
- PC as part of a fab-wide network

SIMPLICITY OF DESIGN AND OPERATION

All the sensors are incorporated within the normal footprint of the pumping system. The system can be controlled and monitored from an optional Pump Display Module.

This module allows all parameters to be checked, set points to be edited and gives warnings of problems together with the most probable cause. To allow both remote and local monitoring a second module can be located in the clean room, next to the process tool. Display modules can be panel mounted if preferred.

After starting the pump locally or remotely the module can be removed, whether intentionally, in order to prevent unauthorised changes, or accidentally. The system is configured to ensure that removal does not cause the pump to shutdown.

The various iQ modules are in constant communication with each other. Warnings are given when a pump's operating conditions are abnormal but the faults are not yet serious. Alarms indicate serious faults which result in pump shut-down. The monitored sensors, except for switch-type sensors such as the oil-level monitors, have four setpoints: low warning, high warning, low alarm and high alarm. The microprocessors in the modules continuously compare the actual values with these setpoints. The latest 300 events (per pump) and 200 measurements (per module) are logged. An event is a change of state: when the pump is switched off, for example. There is an independent safety system which will operate in the unlikely event of a complete failure of the microprocessors.

GLOBAL STANDARD PUMP SYSTEMS

The pump is provided as a separate entity which is a global standard no matter which OEM tool is used. This makes it easy to roll-out a pump for service and roll-in a pump from stock, reducing stocking requirements and minimising additional downtime.

As a modular distributed control system the *iQ* is a platform for the future, allowing the addition of new process specific sensors without any reconfiguration.



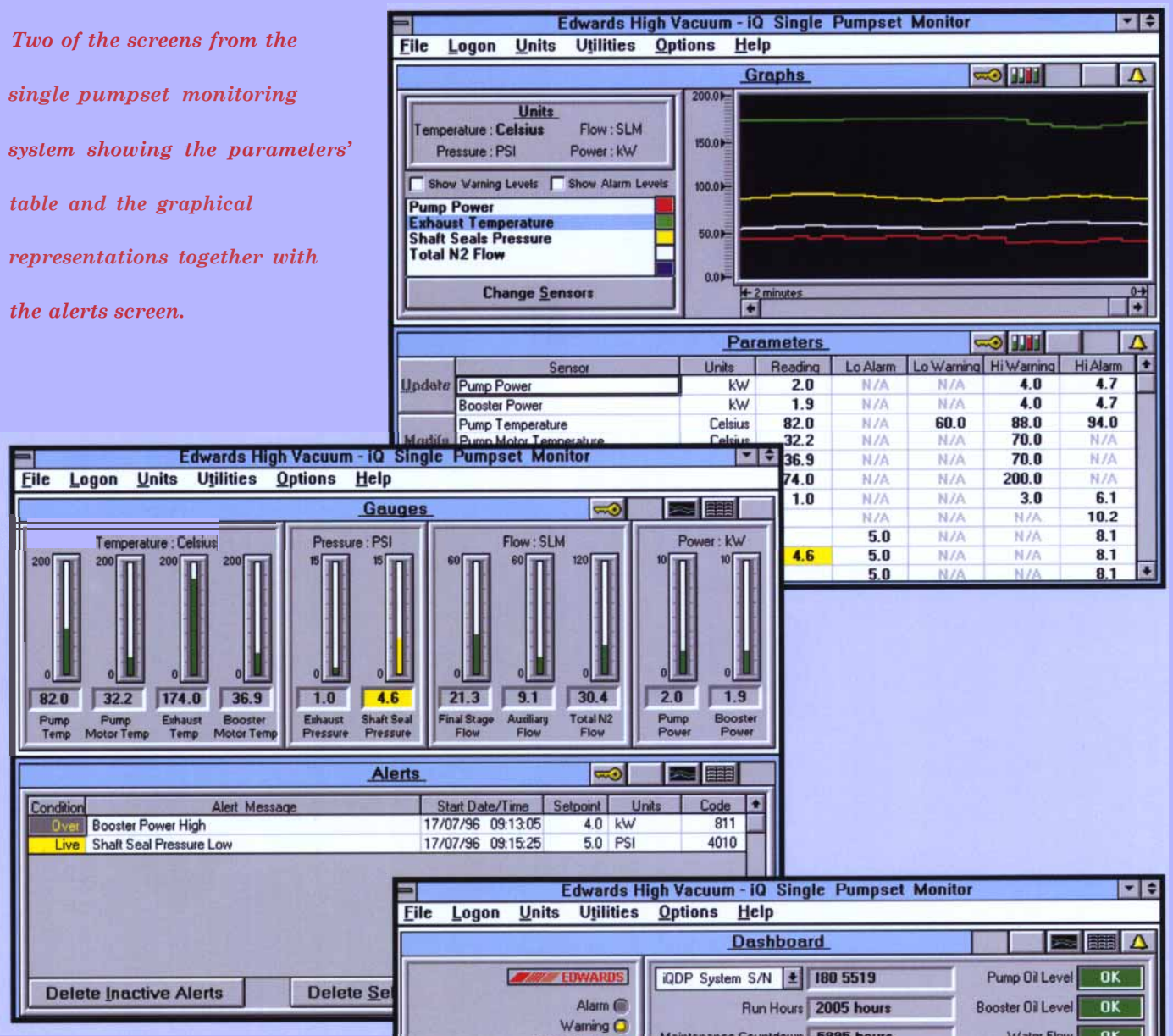


Hand held LCD pump display module provides access to:

- *System control and configuration*
- *System status and monitored values*
- *Diagnostics and recommended corrective action*

EDWARDS SINGLE PUMPSET MONITORING SYSTEM

Two of the screens from the single pumpset monitoring system showing the parameters' table and the graphical representations together with the alerts screen.



The dashboard screen shows the state of the pump, whether the PC has control, the serial numbers and the status of important parameters. The lower screen shows real-time sensor data. Units of measurement can be changed.

INTERFACING AND COMMUNICATIONS

OEM INTERFACES

Working closely with OEM's, Edwards provides interfaces from the iQ pumpsets to all existing and new generation tools.

Advantages of the Tool Interface Module include:

APPLICATION SPECIFIC CONFIGURATION CHECKS

The module communicates with the iQ pumping system via a screened twisted pair link. When a system is switched on or swapped out, a configuration check is made to ensure that the pump combination, gas module and sensors are connected, as specified for the process.

RECORDS PUMP SWAP-OUT AND SERVICE HISTORY

This facility can be used to identify how pumps operate on particular processes and allows electronic tracking of iQ pumps throughout a fab.

AUTOMATIC DOWNLOAD OF SETTINGS

The process-tool specific sensor settings are automatically downloaded to the pump when it is switched on. This allows easy pump swap-out without reconfiguration or the need for manual set-up and consequent potential errors.

INTERFACING TO OTHER VACUUM COMPONENTS

An auxiliary circuit card can be added to drive other vacuum components such as a foreline located gatevalve.

COMMUNICATIONS INTERFACES

Multiple communications interfaces can be added to an iQ pumping system allowing it to communicate over RS232, RS485 and optical fibre. In addition a Sensorbus interface is also available. This capability is unique to Edwards.

PC INTERFACE KIT

A single *iQ* pumpset can be connected and controlled by a PC via the interface kit. The kit consists of a communications module, cables and the Edwards Single Pumpset Monitor software. Used with a portable PC, it is an invaluable tool for service personnel to configure and troubleshoot the iQ pumping system.

The software allows users to graph specific parameters, data log to disc, modify parameter set points and start and stop the pump.

The data stored with the pumpset, which includes events and measurements as well as the pump serial number and customer pump identification, can be uploaded onto a PC. The data can then be used by Edwards service and development engineers for continuous product improvement.

EXPERIENCE THE POWER OF THE iQ CENTRAL MONITORING SYSTEM

- **Fab-wide pump networking power**
- **Real-time monitoring of all pumps**
- **Download process set-ups to pumps**
- **Track pump serial numbers**
- **Network your exhaust management systems**
- **Optional paging system to alert service engineers to pump problems**
- **View the pumps' status and monitor warning conditions**
- **Optional TCP/IP link to fab monitoring systems**
- **Edwards engineers can design your optimum network**
- **Software runs on the familiar Microsoft Windows* platform**

More features are planned which will allow other devices to be added to the network and will provide new applications specific sensor capability for increased diagnostics.

NETWORKED MONITORING AND LOGGING FOR UP TO 1000 PUMPS OR OTHER DEVICES

The iQ Central Monitoring System provides monitoring and logging facilities for up to 1000 pumps.

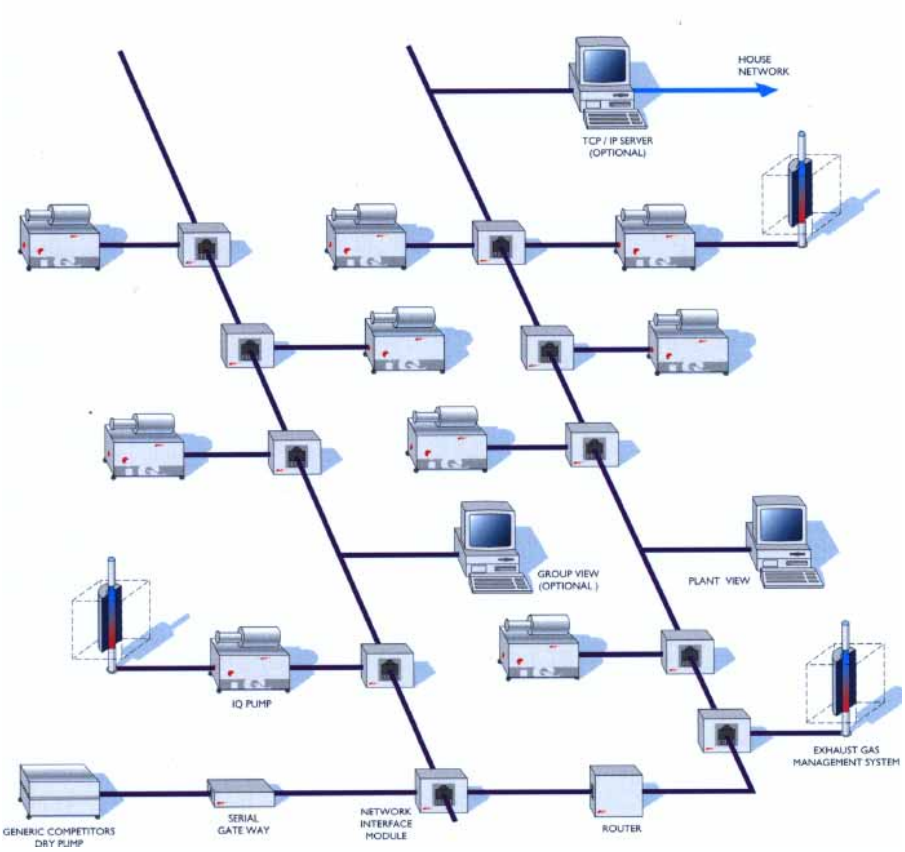
Edwards is expanding the range of intelligent products, exhaust management systems for example, which can be connected into the network.

Groups of iQ pumpsets can be connected together and monitored over a network by a single PC via Network Interface Modules.

These are intelligent devices that allow iQ pumpsets to be swapped out without reconfiguring either the pumpset or the network.

The iQ Network communicates via isolated, screened, twisted pair cable which, unlike the commonly used RS232 system, provides high noise immunity over long distances at high communication rates.

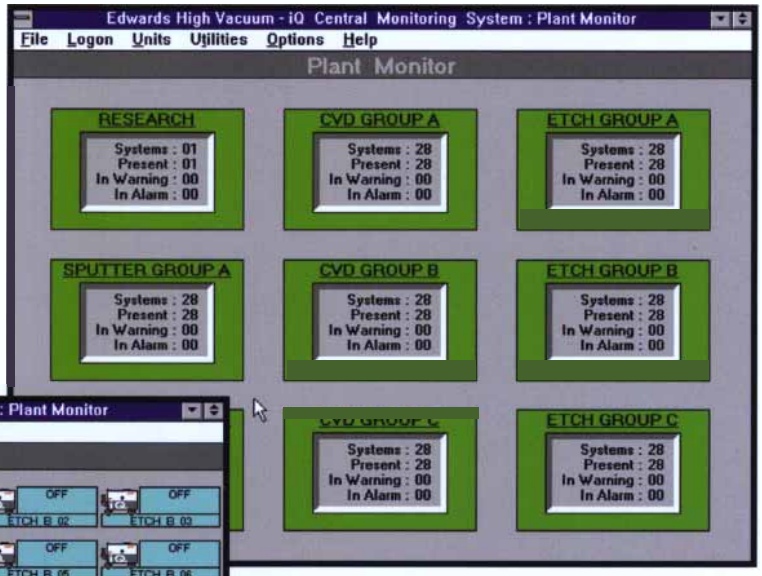
The network is divided into segments of cable 'daisy chained' together through the Network Interface Modules. Segments of up to 1000 metres in length can be linked together using simple routers, without the need for additional repeaters, to form a single network of iQ pumpsets.



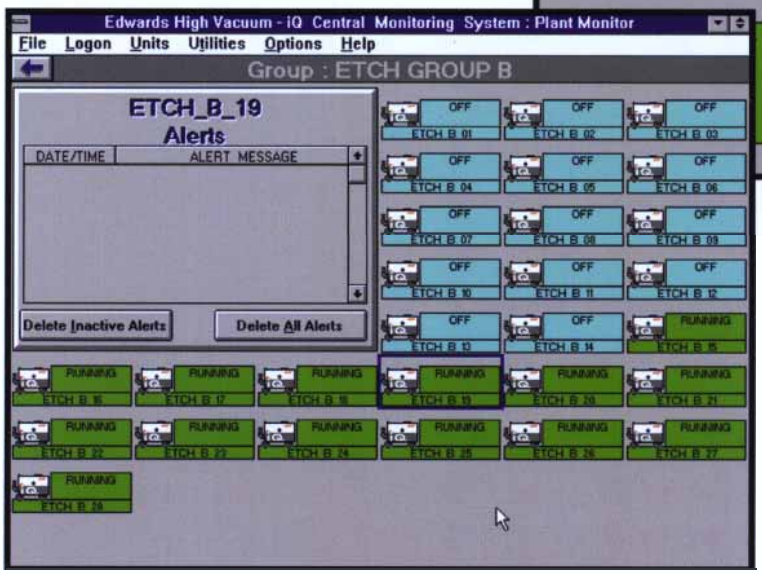
Microsoft is a registered trademark and Windows is a trademark of the Microsoft Corporation

LEVELS OF VIEW - PLANT, GROUP AND SINGLE PUMPSET

There are two versions of the Central Monitoring System software available: Plant View and Group View. The Plant View software includes the Group View program. Both versions include the network version of the Single Pump Monitoring System.



The Plant Monitor screen shows the condition of all the groups on the network. Green indicates that all the devices are working correctly, yellow indicates one or more devices are in warning condition and red indicates one or more devices are in alarm condition.



The Group Monitor shows the condition of all the pumps and gives any alarm messages.

Plant View shows all the groups on the network and indicates how many are operating and how many are in error condition.

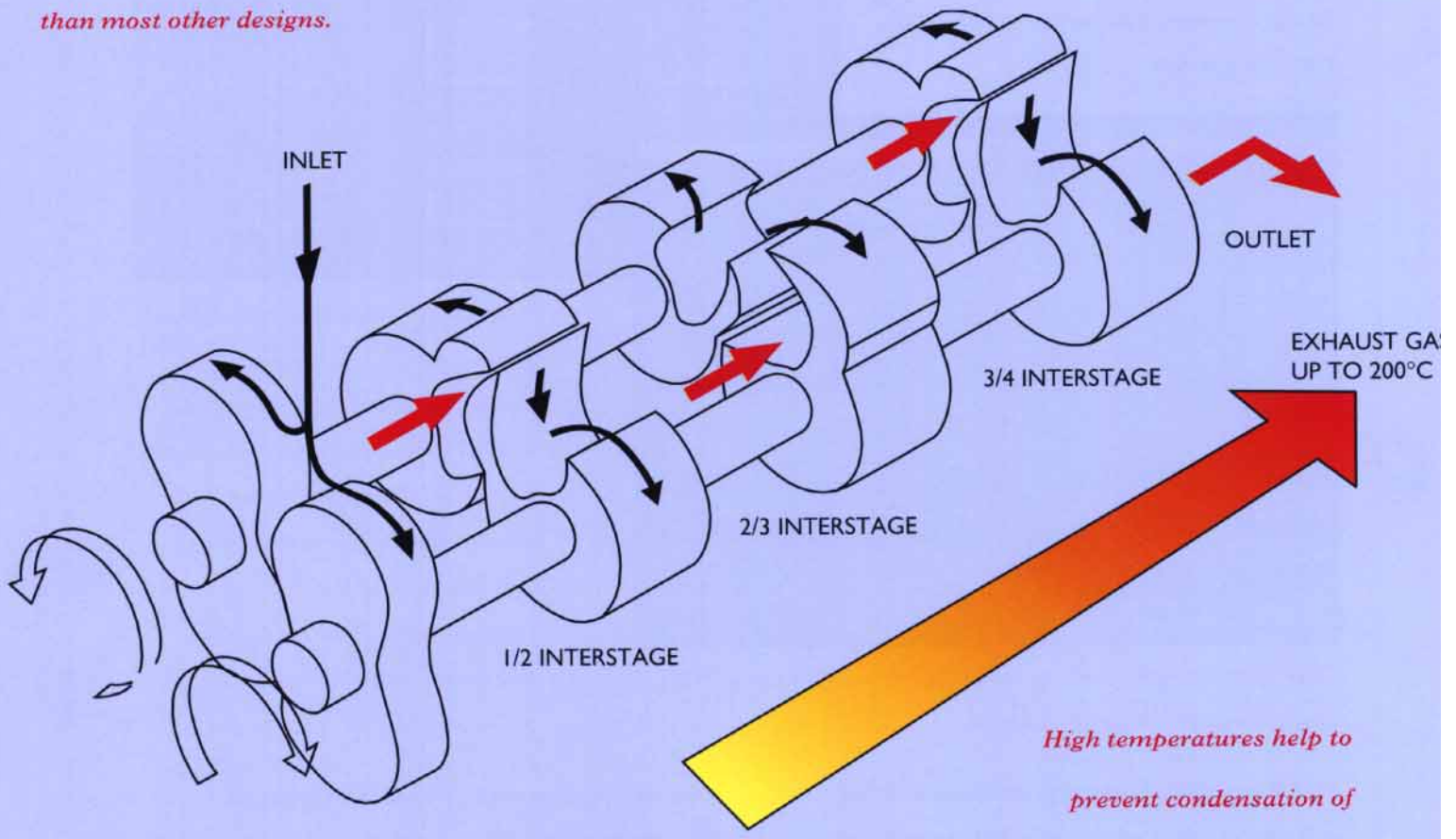
Group View shows all the pumps or other devices in the chosen group and will show if a device is operating or in an error condition. It also displays the log of alarms and warnings.

The user can define groups of pumps at the Group View level. Generally, these will be process related and all of one group will be on one segment of the network. For example, a user could divide pumps into Etch and Deposition or into narrower groups. Groups which span different segments can also be defined. From the group level any pump can be selected for close scrutiny. The screens are similar to those described in the Single Pumpset Monitoring System with the exception that manual control of the pump is not available from the central monitoring system. One PC acts as network manager but there may be several different Plant View versions of the software on the system and each segment can have its own Group View PC.

The iQ pumping system performs on all processes...

THE iQ PUMPING SYSTEM PERFORMS ON ALL PROCESSES...

The Edwards combination of Roots+claw rotor arrangement with inverted claws** on alternate stages gives an internal gas path 60% shorter than most other designs.*



High temperatures help to prevent condensation of process materials

Combining a short gas path, optimum gas temperature and dilution - the iQ pumps perform on all processes. . . . . with increased reliability and safety

* UK patent 2088957B, Japan 1759806

** USA patent 4504201, Japan 1297773, Germany 3244099, other patents pending

. ..WITH INCREASED RELIABILITY

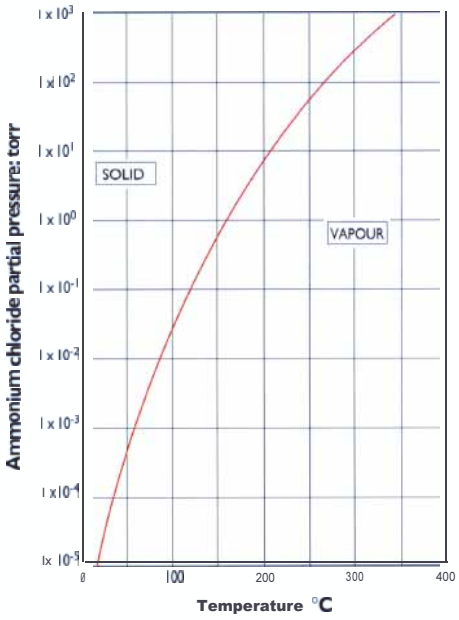
From the beginning of its long association with the semiconductor industry, Edwards has worked with its customers to understand the demands their processes put on vacuum pumping systems. This has led to the development of the iQ Dry Pumping System which incorporates the best pumping mechanism available with the facilities for pump monitoring and diagnostics.

THE HEART OF THE PUMP

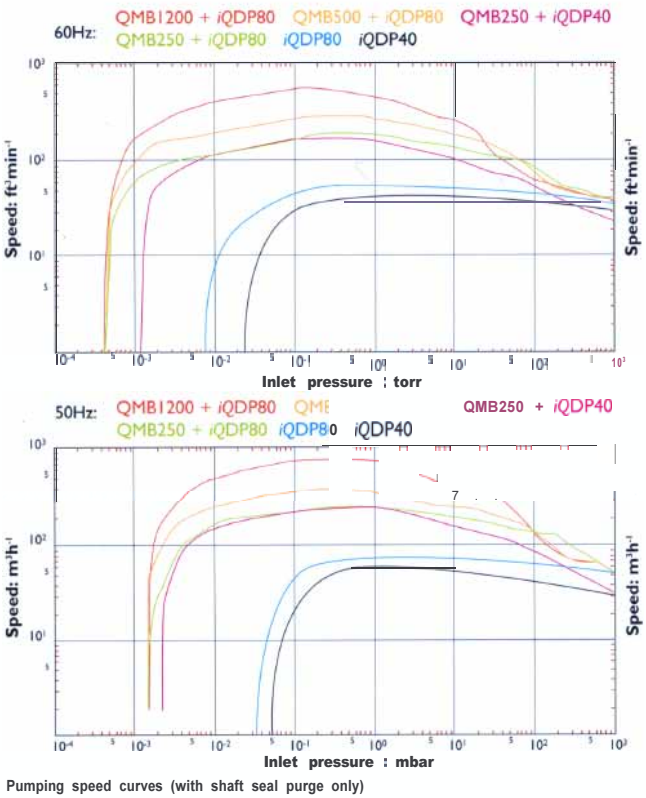
At its heart, the iQ still has the Edwards patented claw arrangement which has been field proven with sales of tens of thousands of pumps. The Edwards design makes it the best choice for the most demanding applications.

DRY NITROGEN SUPPLY AND GAS TEMPERATURES

Edwards pumps allow progressive addition of dry nitrogen across the pump as it is needed for sealing purposes and for minimising by-product condensation. For reasons of safety, many gases, including pyrophorics such as silane, must be diluted either in the pump or at the exhaust. Dilution within the pump gives additional benefits in preventing condensable gases from forming solids in the pump. For example, ammonium chloride, produced in the LPCVD nitride process, can condense in pumps and forelines, ultimately leading to pump failure. Edwards dry pumps have a very short gas path, and are capable of very high exhaust gas temperatures of up to 200°C allowing the gas less opportunity to condense. The temperature can be varied to suit the process. Pumps may be run cooler for processes such as tungsten silicide, where reactions may occur within the pump at high temperatures. An optional sensor monitors exhaust gas temperature. Gas modules are available to suit different processes from load-lock pumps to the most aggressive applications and allow variation of nitrogen flows as required.



The iQ pump maintains the ammonium chloride gas on the vapour side of the curve by using dry nitrogen dilution and high pump temperatures.



Pumping speed curves (with shaft seal purge only)

TECHNICAL DATA

TECHNICAL DATA

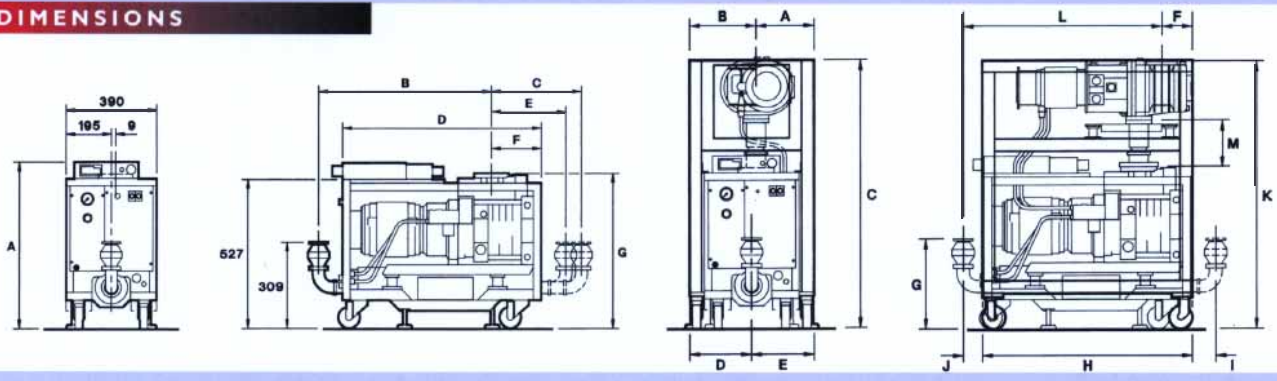
	UNITS	iQDP40		iQDP40/ iQMB250F		iQDP80		iQDP80/ iQMB250F		iQDP80/ iQMB500F		iQDP80/ IQMB I200F	
		50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz
Peak speed*	m^3h^{-1}	44	55	235	290	80	96	260	305	390	460	815	940
	ft^3/min	26	32	138	171	47	56.4	153	180	230	271	480	554
Displacement	m^3h^{-1}	52.0	62.4	310	375	91.5	109.8	310	375	505	605	II95	1435
	ft^3/min	30.6	36.7	183	221	53.9	64.7	183	221	297	356	704	845
Ultimate vacuum with*	mbar	$5x10^{-2}$	$3x10^{-2}$	$2.5x10^{-3}$	$2x10^{-3}$	$3x10^{-2}$	$1x10^{-2}$	$2x10^{-3}$	$7x10^{-4}$	$2x10^{-3}$	$7x10^{-4}$	$2x10^{-3}$	$7x10^{-4}$
shaft seal purge only	torr	$3.8x10^{-2}$	$2.3x10^{-2}$	$2.5x10^{-3}$	$1.5x10^{-3}$	$2.3x10^{-2}$	$7.5x10^{-3}$	$1.5x10^{-3}$	$5.3x10^{-4}$	$1.5x10^{-3}$	$5.3x10^{-4}$	$1.5x10^{-3}$	$5.3x10^{-4}$
Typical shaft seal nitrogen flow	slm	I2		I2		I2		I2		I2		I2	
Warm up time	min	I5		I5		I5		I5		I5		I5	
Inlet connection		IS040		IS063		IS063		ISO63		ISO 100		ISO I60	
Outlet connection		NW40		NW40		NW40		NW40		NW40		NW40	
Typical cooling water flow													
Exhaust gas	lh^{-1}	I35[2]		225"		125		210		210		210	
Temperature I45°C[1]	US gal/min	0.60		I.o		0.55		0.93		0.93		0.93	
Weight[3]	kg	186		313		216		346		359		450	
Power input at vacuum													
iQDP	kW	I.1	1.3	1.1	1.3	2.6	3.1	2.6	3.1	2.6	3.1	2.6	3.1
iQMB	kW	n/a	n/a	0.7	I.o	n/a	n/a	0.7	I.o	0.6	0.9	1.1	I.7
Rated motor power													
iQDP	kW	2.2		2.2		4.0		4.0		4.0		4.0	
iQMB	kW	n/a		2.2		n/a		2.2		2.2		4.0	
Oil capacity													
iQDP	l	0.4		0.4		0.4		0.4		0.4		0.4	
iQMB													
Coupling cover	l	n/a		1.5		n/a		1.5		1.5		2.4	
Shaft seal reservoir				0. I25				0. I25		0. I25		0. I25	
Gear case								–		–		I.25	

(1) For lower exhaust gas temperatures increased water flow is required. (2) For exhaust gas temperatures of 125°C.

(3) Weight includes: electrlcs controller; gas module and frames plus connection kits for booster combinations.

* Typical performance.

DIMENSIONS



iQDP40 AND iQDP80 PUMPING SYSTEM

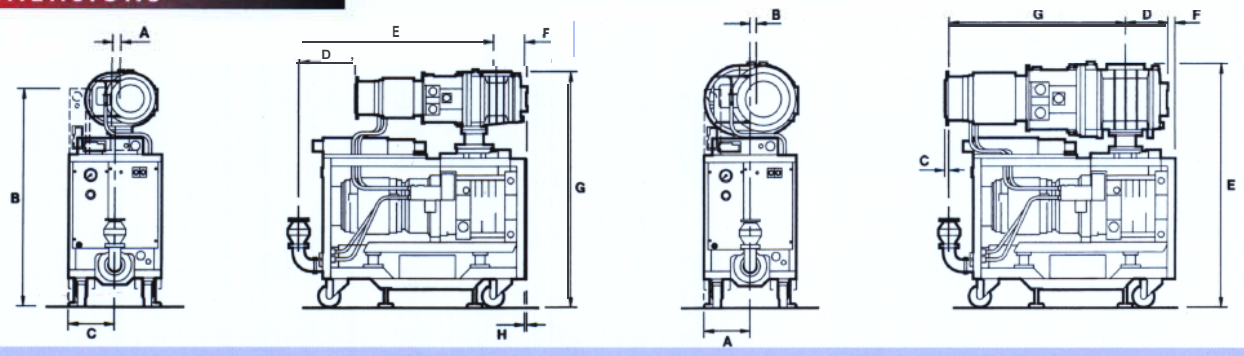
PUMPING SYSTEM	A	B	C	D	E	F	G
iQDP40	597	581	–	695	371	199	554
iQDP80	597	723	337	830	283	188	528

iQDP80 AND iQMB BOOSTER FRAME MOUNTED PUMPING SYSTEM

PUMPING SYSTEM	A	B	C	D	E	F	G	H	I	J	K	L	M
iQDP80 / iQMB250F	251.5	268.5	990	260	260	140.5	314	890	98.5	71.5	967	821	204
iQDP80 / iQMB5OOF	251.5	268.5	990	260	260	238.5	314	890	98.5	71.5	948	723	204
iQDP80 / iQMB I2OOF	25 I .5	268.5	1050	260	260	318.5	314	1050	69.5"	79.5	1018	811	218

A In thrs pump combination, the centre of the exhaust-silencer check-valve is 69.Smm inside the end of the iQM6 Booster Frame.

DIMENSIONS



iQDP AND iQMB BOOSTER DIRECT MOUNTED PUMPING SYSTEM

PUMPING SYSTEM	A	B	C	D	E	F	G	H
iQDP40 / iQMB250F	8.5	798	195	1I6	679	137	860.5[B]	36
iQDP80 / iQMB250F	8.5	-	195	258	82 I .5	137	842	46
iQDP80 / iQMB5OOF	195	8.5	-I I7C	179	819.5	9	723	

B Electrics Module mounted horizontally. With the electrics Module mounted vertically, this height is 784

C For this pump combination, the centre of the check-valve extends I I7mm beyond the end ofthe iQMB pump-motor

STANDARD iQ DRYPUMP CONFIGURATION

PROCESS, e.g. CVD, ETCH etc.

iQ 80 pump combination with 1200, 500 or 250 mechanical booster, fully enclosed with harsh duty gas module and pump display module. Three phase electrical supplies.

iQ 1200H

208V 60Hz	iQ715 1004
415V 50Hz	iQ715 1007

iQ 500H

208V 60Hz	iQ615 1004
415V 50Hz	iQ615 1007

iQ 250H

208V 60Hz	iQ515 1004
415V 50Hz	iQ515 1007

iQ **80** fully enclosed pump with harsh duty gas module, pump display module and all optional sensors *. Three phase electrical supplies.

iQ 80H

208V 60Hz	iQ211 1004
415V 50Hz	iQ211 1007

CLEAN, e.g. LOAD LOCK, PVD etc.

iQ **80** pump combination with 500 or 250 mechanical booster, fully enclosed with clean duty gas module and pump display module only. Three phase electrical supplies.

iQ 500C

208V 60Hz	iQ 635 1004
415V 50Hz	iQ635 1007

iQ 250C

208V 60Hz	iQ535 1004
415V 50Hz	iQ535 1007

iQ **80** or iQ **40** fully enclosed pump with clean duty gas display modules and pump display module only. Three phase electrical supplies.

iQ 80C

208V 60Hz	iQ231 1004
415V 50Hz	iQ231 1007

iQ 40C

208V 60Hz	iQ 131 1004
415V 50Hz	iQ 131 1007

Edwards scroll pump

ESDP 30A	A7 1003908

*** Optional sensors may be added including oil level monitor, water flow switch and exhaust gas temperature sensor.**

ORDERING INFORMATION

CUSTOM iQ DRY PUMP CONFIGURATIONS



PUMPS

1. iQDP40
2. iQDP 80
3. iQDP 40 / iQMB 250F (Vertically mounted electrics box)
4. iQDP 40 / iQMB 500F
5. iQDP 80 / iQMB 250F
6. iQDP 80 / iQMB 500F
7. iQDP 80 / iQMB 1200F
8. iQDP 40 I iQMB 250F (Horizontally mounted electrics box)

GAS CONTROL

1. Harsh Process e.g. LPCVD, PECVD, metal etch
2. Medium Process e.g. Fluorine chemistry etch
3. Clean Process e.g. load lock, PVD

BOOSTER MOUNTING AND ENCLOSURES

0. Unenclosed Pump
1. Enclosed Pump
2. Direct Mounted, No Enclosures*
3. Direct Mounted, iQDP Enclosures*
4. Frame Mounted, No Enclosures
5. Frame Mounted, Fully Enclosured

* (iQMB 1200 Not Available Direct Mount)

CONTROL

0. No Pump Display Module
1. Pump Display Module

OPTIONAL SENSORS

0. None
1. Oil Level Monitor(s)
2. Water Flow Switch
3. Exhaust Gas Temperature Sensor
4. Oil Level Monitor(s) Plus Water Flow Switch
5. Oil Level Monitor(s) Plus Exhaust Gas Temp. Sensor
6. Water Flow Switch Plus Exhaust Gas Temp. Sensor
7. Oil Level Monitor(s) Plus Water Flow Switch Plus Exhaust Gas Temperature Sensor

ELECTRICAL SUPPLY

1.	200 V	50HZ	3PH
2.	200 v	60HZ	3PH
3.	208 V	50HZ	3PH
4.	208 V	60HZ	3PH
5.	230 V	60HZ	3PH
6.	380 V	50HZ	3PH
7.	415v	50HZ	3PH
8.	460 V	60HZ	3PH

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