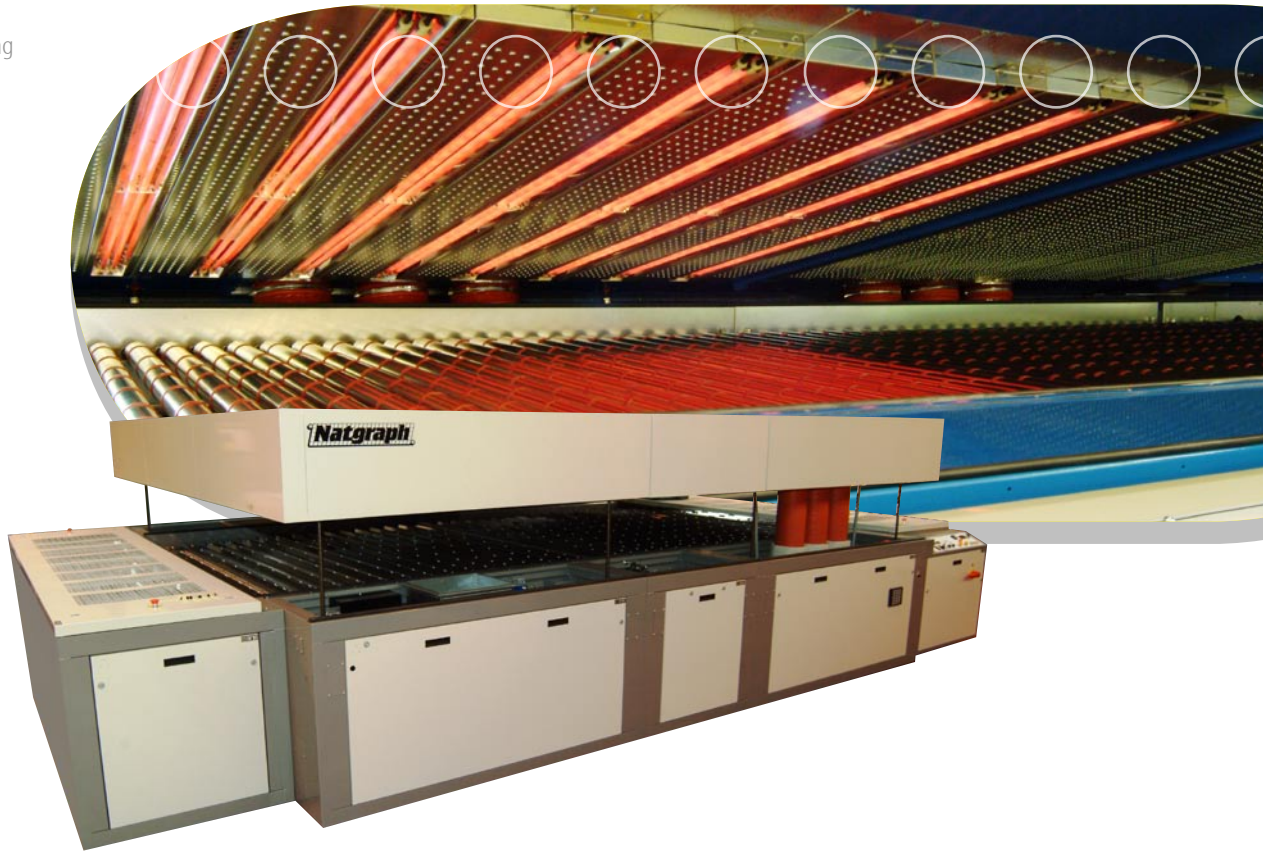
Natgraph
EQUIPMENT SOLUTIONS

ULTRA-VIOLET SCREENPRINTING | FORCED AIR STENCIL EXPOSURE | INFRA-RED DRYING TECHNOLOGY

Air Force IR Glass Dryers

- stencil processing
- screen printing
- air force
- ultra violet
- infra red



Natgraph manufacture a range of Air Force IR Glass Dryers that has been developed from years of experience gained in the production of 100's of IR High Temperature Conveyorised Systems, that are in world-wide daily use. These versatile dryers have the ability to dry typically 'slow' pine oil and water miscible inks using a combination of Infra Red radiation with Hot Air and ambient or refrigerated air cooling from above and below.

These dryers have been designed, developed and manufactured for drying surface coatings applied to glass products from 0.6mm through to 24mm thick and up to 3m wide. This glass is used in the automotive, architectural, domestic appliance, solar energy, electronic display and furniture industries. Whatever the requirement for drying ceramic inks onto glass, Natgraph have a solution.

With 5 standard belt widths, Touch Screen PLC Control System, 4 layouts, combined Hot Air/IR lamp systems, double sided cooling, special transport systems and modular design, this range of dryers is extremely adaptable, versatile and efficient.

Air Force IR Glass Dryers
Drying Modules
Extraction Modules
Cooling Modules
Transport Systems

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Member SGIA DSPA

Air Force IR Glass Dryers

Infra Red lamps and air nozzles

Features

- Touch Screen, PLC Control System
- High temperature operation, optionally up to 200°C
- 16 medium wave IR lamps per 2m module
- High efficiency vented stainless steel reflectors
- Gas filled hood lifting arms
- Modular construction
- Steel bar or P.T.F.E. coated fibre glass mesh transport systems
- Castors & jacking feet
- Colour coded to industry standards
- Optional recirculation filters
- Optional inlet filter
- Optional thyristor control

Easy Access

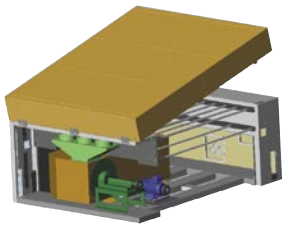
The Natgraph range of Air Force IR Glass Dryers is available in 5 belt widths from 70cm through to 260cm, with a comprehensive selection of module types available depending upon the production line requirements. A combination of IR/Hot Air, with extra Hot Air, Extraction, Ambient Cooling or Refrigerated Cooling Modules, make these dryers extremely adaptable.

Optimum Dryer Design

The solvents contained in ceramic inks are commonly pine oil based and so, very slow to force dry. Also the glass can be up to 24mm thick, thus forming a massive 'heat sink' below the ink, absorbing the energy that is needed to accelerate the evaporation of solvents.

When Natgraph configures the specification of a glass dryer, the considerations are:-

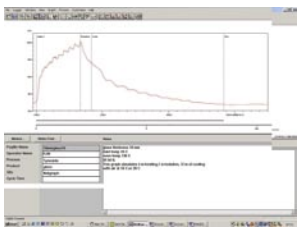
- Ink type
- Ink layer thickness
- Line speed
- Maximum glass thickness
- Maximum & minimum glass sizes
- Glass exit temperature

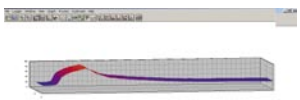


Hot air/IR module

Taking these factors into account, the dryer is specified utilizing a combination of the following modules:-

IR Hot Air Modules





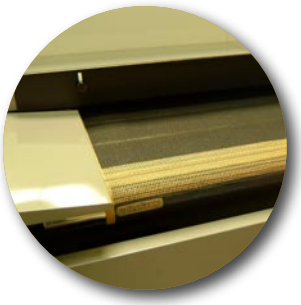
The construction of these High Temperature dryers is completely different from standard units, with extra insulation layers and air gaps required to keep the external surfaces cool, even though it can be over 200°C inside the dryer. The air recirculation system uses a different principle, as the hot air needs to be retained in a specially insulated, inner ducting system that has additional insulation layers.

The air is recirculated by being drawn down through the belt into the top of a high efficiency, stainless steel 'hot box' in which the impeller of the special fan rotates to force the air through the fast response electrical heating elements. The air is then forced up through the stainless steel ductwork into the triple skinned hood.

The recirculation fans are a special type with an external bearing arrangement, these are vee belt driven via separate motors that have ducting systems attached to provide cool air. The hot air is delivered onto the glass through a pattern of special nozzles in removable galvanised steel jet plates located in the hood. This system ensures that an even temperature and drying efficiency is achieved all over the glass surface.

The inclusion of IR drying does not extend the length of the dryer, as the IR lamp system is incorporated within the 2m hot air module. The medium wave IR lamps are located in vented stainless steel reflectors, that are positioned within the forced air, recessed into special jet plates. Each reflector can accept 2 IR lamps with a maximum of 16 lamps in each 2m hot air module. The lamps are selected in alternate banks to give half or full power operation as standard, or can have an optional thyristor drive fitted to give control of the lamps on a percentage basis.

Extraction Modules

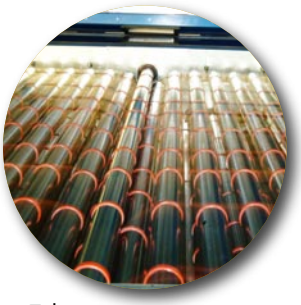


PTFE Coated fibre glass mesh belt

To ensure safe and efficient operation, all gases emitted from the ink during the drying process are extracted from the dryer, internal extraction ducting is provided within the heating modules, or alternatively a separate evaporation/extraction module can be included.

Cooling Modules

The required exit temperature of the glass determines the type and number of cooling modules needed. Natgraph's unique, double sided cooling system uses either ambient or refrigerated air. The refrigerated air modules recirculate the air through an internal cooling coil (with air filter), that is connected to an external chiller plant by flexible pipework. Water is cooled by the chiller plant as required to maintain a controlled air temperature within the module. The chiller plant requires a separate electrical power supply, but is controlled from the dryers PLC system.



Tube transport system in changeover module

Transport Systems

Flat glass to be screenprinted can typically vary in thickness from 0.6mm to 24mm, with sizes from 10cm to 3m wide, weighing up to 500kgs per piece, therefore the transportation for each application may require a specific conveyor system. Variable speed, P.T.F.E. coated, fibre glass mesh belts are the most common and economical solution.

If very large, heavy glass is to be reliably transported, a driven chain/bar system or driven rollers will be required, the choice of which will depend upon the minimum glass size. These systems support the glass with the minimum of contact to maintain the dryer's efficiency of heating and cooling. In the case of refrigerated cooling, the transport system is assembled in 2 sections, split in the 1m Extraction Module, this separates the hot conveyor from the refrigerated one thereby increasing the efficiency of the dryer.

These dryers require a three phase power supply.

Heavy duty bar transport system

Options

Inlet Filter

An optional Inlet Filter stack can be fitted to each dedicated air inlet to ensure that the air being drawn into the dryer is free of dirt and dust. This freestanding filter stack has a replaceable, slide in unit, with a filter rating of EU4 (4 microns) and has been designed to maintain air efficiency for the dryer, whilst preventing contamination.

Inlet Air Filter Stacks

Thyristor Drives

An optional Thyristor Drive can be fitted to control the output of the IR lamps on a percentage basis, this system can be very useful when the effects of the IR can be critical, or are unknown. The Thyristor is controlled by the Touch Screen PLC Control System with a digital output.

Inverter Drives for Fan Motors

An optional Inverter Drive can be fitted to control the air speed at the glass surface, this can be useful when very thin, or metallic inks are to be dried at high speed in the same dryer to be used for thicker, conventional ceramic inks.

Specifications

Air Force IR Glass Dryers

The following specifications are common to all Air Force Dryers

Belt Height	98– 113cm (38 - 44") Adjustable by the dryer's feet, higher options available.
Belt Speed	1 – 10m per minute (3' – 30') Other speeds are available to order.
Module Height	Model 90 – 170 = 142cm – 157cm (56 – 62") Adjustable by the dryer's feet. Model 225 = 144cm (57"). Models 260 & 300 = 151cm (60") minimum.
Module Length	2m (79")
Voltage	Three Phase 400 Volts 50/60 Hz. AC

These figures apply to individual model sizes.

Model No.	**90**	**130**	**155**	**170**	**225**	**260**	**300**
Belt/Drying/Curing Width	90cm (36")	130cm (51")	155cm (61")	170cm (67")	225cm (89")	260cm (102")	300cm (118")
Module Width	240cm (95")	280cm (111")	305cm (120")	320cm (126")	415cm (164")	448.5cm (177")	488.5cm (193")

(Weights can be confirmed by Natgraph depending upon the size/type and number of modules used.)

Electrical							
Module Type	2m, IR medium pressure hot (160°C maximum), air modules						
Model No.	**90**	**130**	**155**	**170**	**225**	**260**	**300**
Heating Elements	30kW	36kW	36kW	42kW	42kW	72kW	72kW
Current (Max. Amps)	44	52	52	60	60	104	104
Infra Red Lamps (16)	26.4kW	38.4kW	44.8kW	48kW	64kW	75.2kW	75.2kW
Current (Max. Amps)	38	55.5	65	70	93	108.6	108.6
Motor(s)	3kW	3kW	4kW	5.5kW	8kW	8kW	8kW
Current (Max. Amps)	4.4	4.4	5.7	7.7	11.4	11.4	11.4
Module Type	1m, extraction (change over) modules.						
Motor	1.5	1.5	1.5	2.2	3	3	3
Current (Max. Amps)	2.4	2.4	2.4	3.4	4.4	4.4	4.4
Module Type	2m, high pressure cold (ambient), air modules.						
Motor(s)	7.4kW	7.4kW	10kW	12kW	13.5kW	13.5kW	13.5kW
Current (Max. Amps)	11.2	11.2	14.5	17	19	19	19
Module Type	2m, high pressure cold (refrigerated), air modules.						
Motor(s)	4.4kW	4.4kW	6kW	8kW	8kW	8kW	8kW
Current (Max. Amps)	6.7	6.7	8.8	11.4	11.4	11.4	11.4
External Chiller Unit	13.9kW	13.9kW	18kW	18kW	18kW	18kW	18kW
Current	23	23	31	31	31	31	31
Air	Figures are in 1,000m3/hour, per 2m module						
Model No.	**90**	**130**	**155**	**170**	**225**	**260**	**300**
Module Type	2m, high pressure hot (160 °C maximum), air modules						
Recirculated Air	4.8	5.5	6.3	7	8.5	11	tbc
Exhaust Air (Adjustable)	0.5 - 1	0.7 – 1.2	0.8 – 1.5	0.8 – 1.5	1 - 2	1.4 – 2.4	tbc
Module Type	1m, extraction, (change over) modules.						
Exhaust Air	1.5	1.5	2	2	tbc	tbc	tbc
Module Type	2m cold (ambient), air modules.						
Intake Air	6	7	7.5	8	10	12	tbc
Exhaust Air	7	8	8	8	12	13	tbc
Module Type	2m, high pressure, cold (refrigerated), air modules.						
Re-circulated Air	6	7	7.5	8	10	12	tbc

NOTE: When calculating power supply sizes for Air Force Dryers, add all the motor and heating element currents of the modules involved together to give the final figure. For Air Force/UV Combinations, add all the motor currents of the modules involved to the lamp current, but do not include the heating elements. This is because a safety interlock ensures that the air heating elements and UV lamps cannot be used at the same time. The UV lamp currents are calculated with 2 lamps at full power.
Example: Model 110 Air Force Dryer, 2m warm, 2m cold = 26 + 7 + 7 = 40 Amps. Model 110 Air Force UV/Combination Dryer, 2m warm, 2m 2 lamp UV cold = 7 + 60 +7 = 74 Amps.
Typical power consumption of a Model 110 Air Force Dryer, 2m warm, 2m cold, running at 50°C with an ambient temperature of 20°C is 10kW per hour (including all motors), at average U.K. power costings, this represents a running cost of below 70p per hour.

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