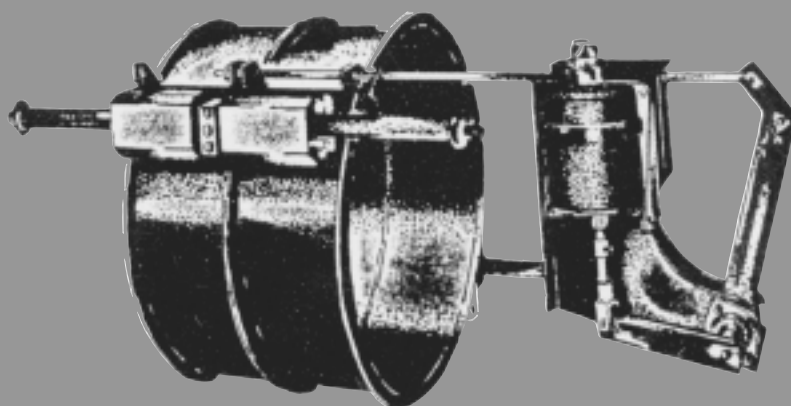


ROSEMEX

VARIMARK II

CENTRIFUGAL FAN VOLUME CONTROL



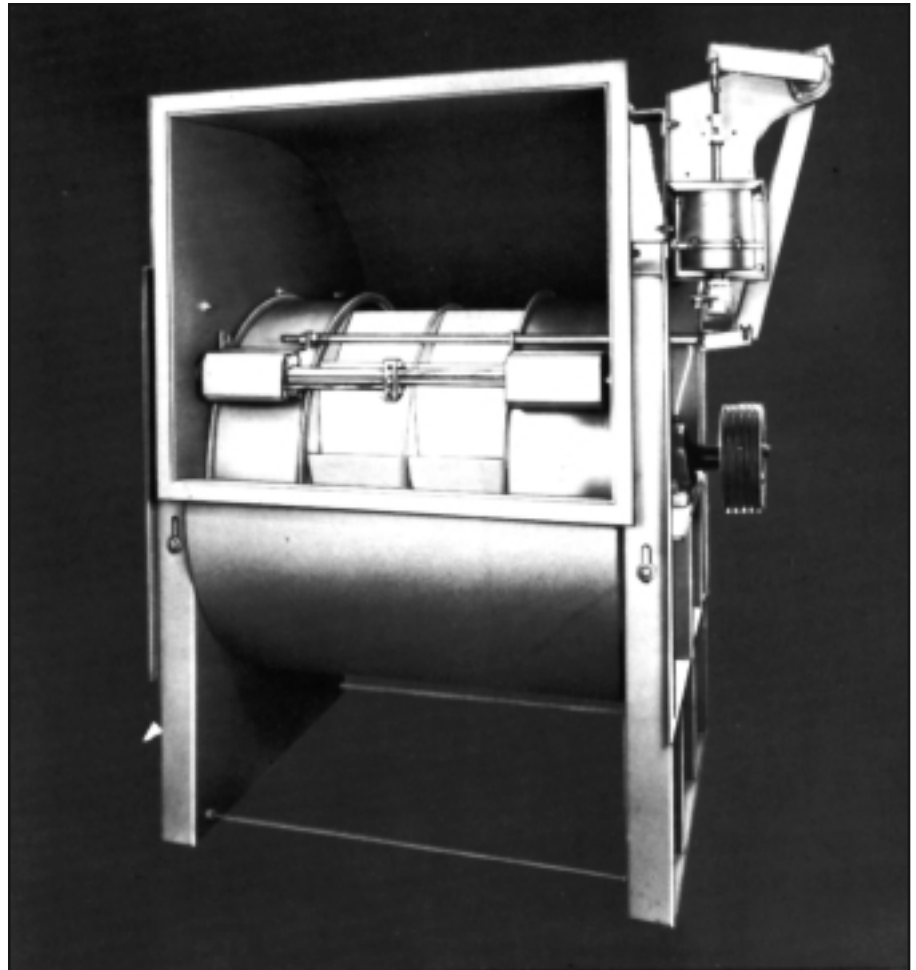
INTRODUCTION

CENTRIFUGAL FAN MODULATING DEVICE

Because of the emphasis put on energy savings, variable volume air flow is now required for most new buildings or when renovating old ones.

To meet these modern technical needs, Rosemex has available a unique patented centrifugal fan modulating device, the Varimark II.

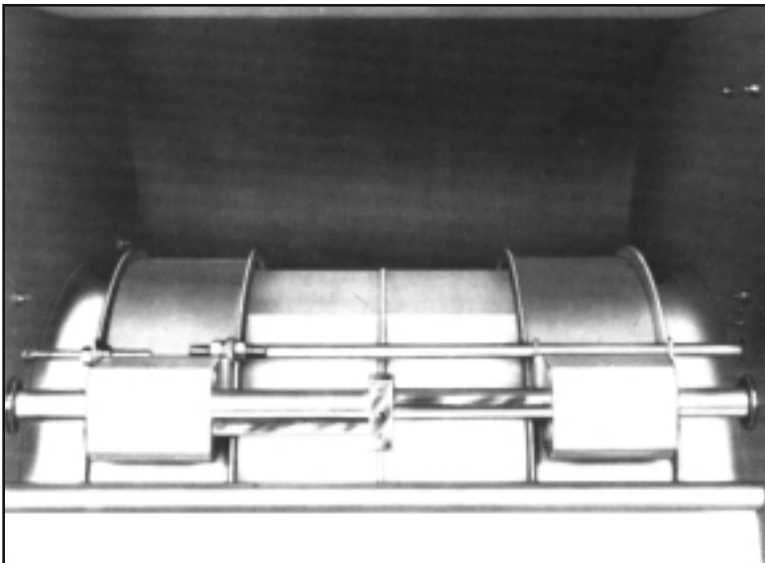
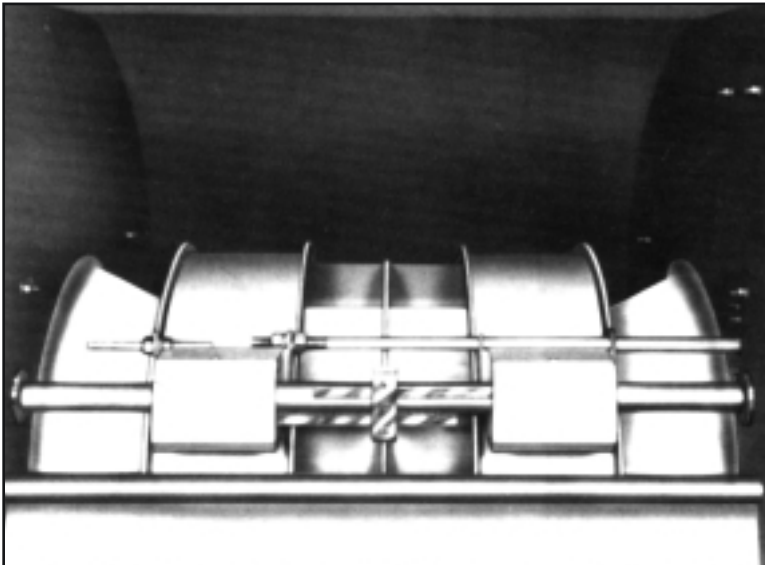
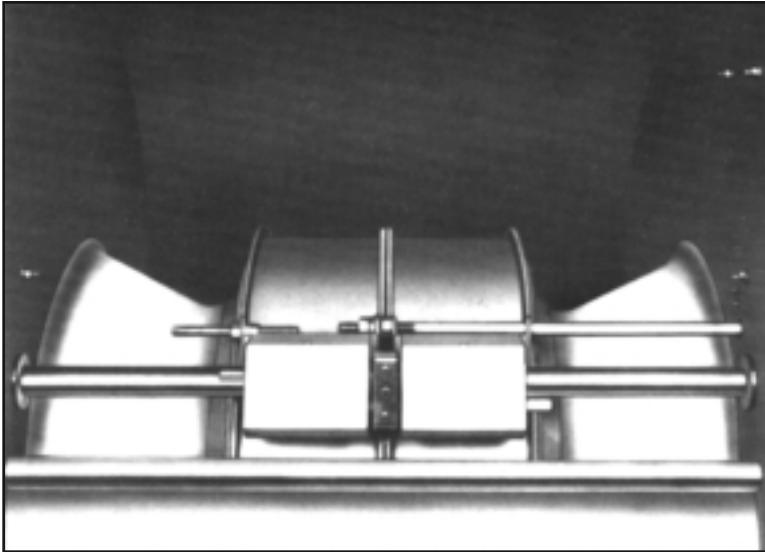
Canadian Patent No. 1044672
U.S. Patent No. 4135850
Patent applied for in other countries.



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APPLICATION FEATURES



THE VARIMARK II

An approach to variable air volume control system that has no equal.

Designed on the principle that a reduction of the effective width of a Backwardly Inclined or Airfoil centrifugal fan wheel decreases both the CFM and SP, the Varimark II consists of cylindrical dampers sliding over the wheel. This patented device, developed by Rosemex, offers a degree of efficiency, accuracy, flexibility and long life unmatched by any existing mechanism in the same price range. Activated by pressure sensors in the duct work, the Varimark II decreases air volume from 100% to 20% while maintaining fan high efficiency throughout the complete operating range.

FEATURES OF THE VARIMARK II

- Eliminates fan surge and system instability.
- Energy savings are realized not only on fan operation, but most important by reducing load on chiller and boiler.
- Superior acoustical performance since the most efficient fan for the job is selected.
- Rugged, maintenance-free mechanism.
- Low pressure control air line (only 20 PSI) is needed for Varimark II operation even on large size fan.
- The ideal solution for retrofitting existing fans.

PHYSICAL FEATURES



CYLINDRICAL DAMPERS

On fans from 12" to 44" diameter, Varimark II dampers are made of sheet steel and from 49" diameter up, aluminum alloy sheet is used. Dampers are reinforced by rings, channel rings and cross channels as required for the different blower classes.

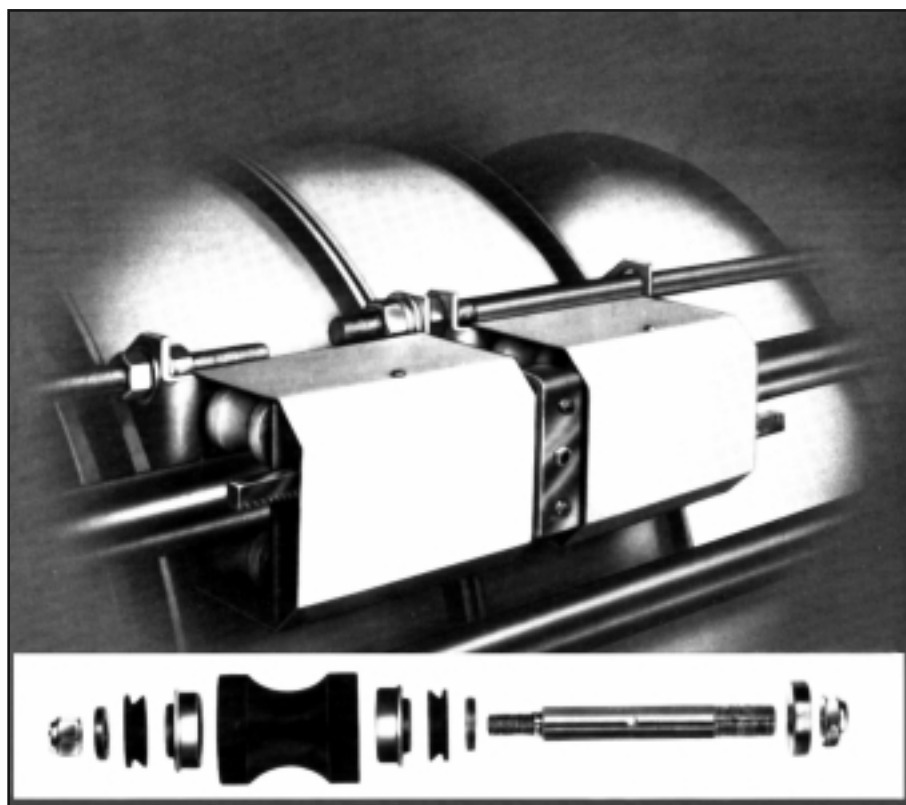
DAMPER CARRIAGES AND GUIDE TUBES

Each damper is supported by two carriages, 180° apart, and on each carriage are mounted 4 polyurethane rollers turning on permanently sealed and greased ball bearings. On fans 22" diameter and larger, two roller shafts out of four per carriage are eccentric to allow for play adjustment. The carriages and their damper travel back and forth on two guide tubes made from electrically welded, chrome plated tubing. Both tube ends are firmly bolted to the fan casing.

On DWDI fans 36" diameter and larger, a reinforcing tube is added for each guide tube.

DAMPER OPTIONS

Varimark II is normally closed; normally open option is available upon request.

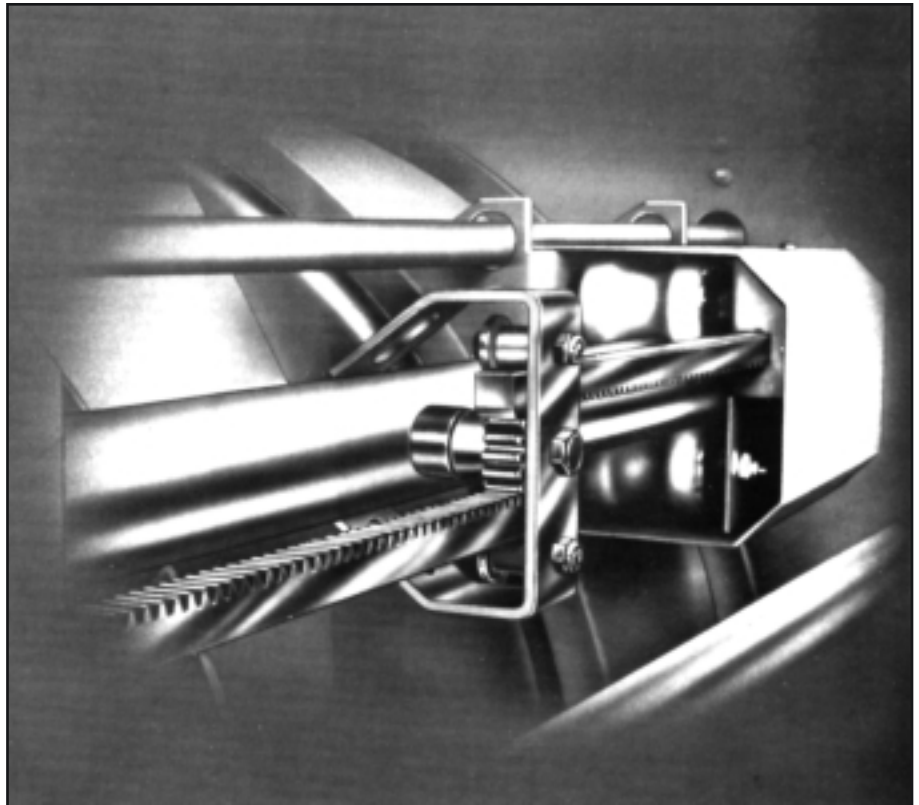


PHYSICAL FEATURES

DRIVE MECHANISM

A positioning rod has one end fastened to the pneumatic operator and the other end to one of the damper carriages.

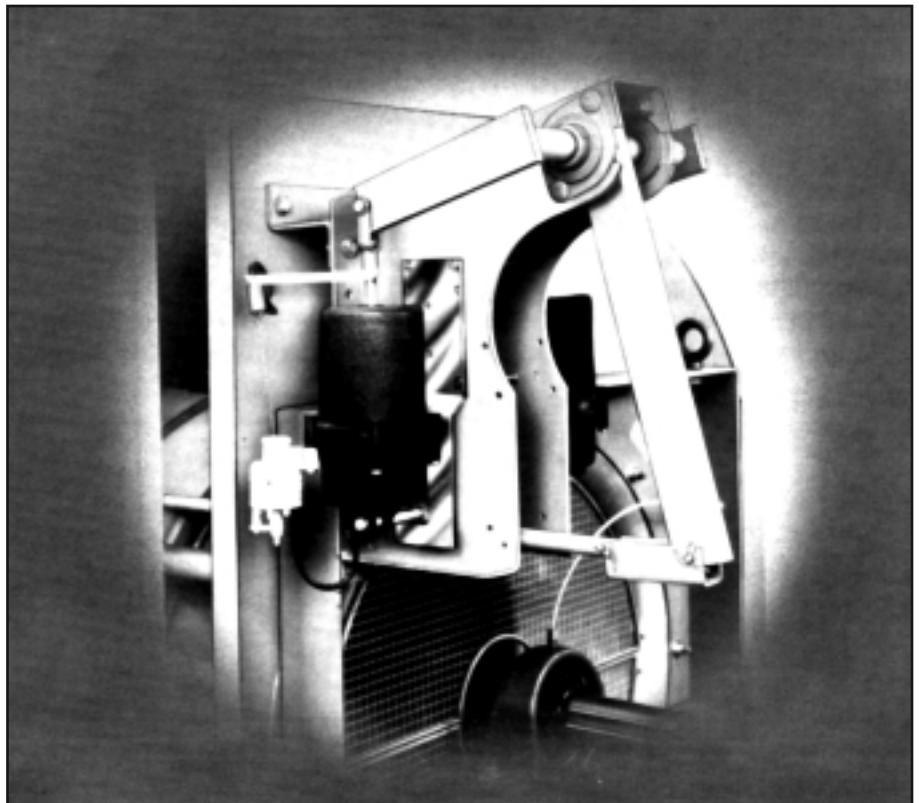
On DWDI fans, the action of the positioning rod on the carriage is transferred to the adjacent carriage of the other damper through a rack and pinion mechanism. This mechanism is supported and protected by a heavy gauge steel housing. Racks and pinion are chrome plated and the pinion rotates on a nylon bushing. Complete travel range will take dampers from center of wheel (closed position) to each side of fan casing, thus completely uncovering wheel (open position).



On SWSI fans, only one cylindrical damper is used, eliminating the need of racks and pinion. The positioning rod pushes or pulls the damper to cover (closed position) or uncover (open position) the wheel.

PNEUMATIC OPERATOR BRACKET

Pneumatic operator brackets vary to accept most makes of operators. Lever mechanism using 1 3/16" diameter S.A.E. 1045 shafting, mounted on sealed flange ball bearings, transfers operator movement to positioning rod with a minimum of friction loss.



PNEUMATIC OPERATOR

For choice of pneumatic operator, consult your local Rosemex representative.

VARIABLE AIR VOLUME SYSTEMS

Being more sophisticated than conventional systems due to wide fluctuations of air volume, VAV systems require more care in choosing both the fans

and their modulating devices. Furthermore, the operation of VAV terminal units cause the system curve to be modified and shifted away from the

point of zero SP and zero CFM to the minimum SP required for efficient operation of these units.

CENTRIFUGAL FAN MODULATING DEVICES

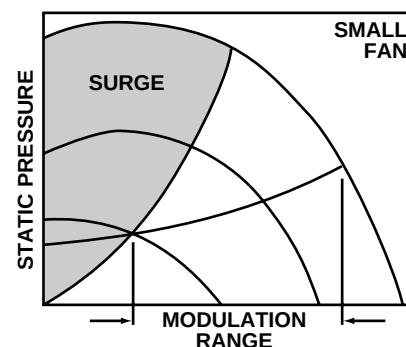
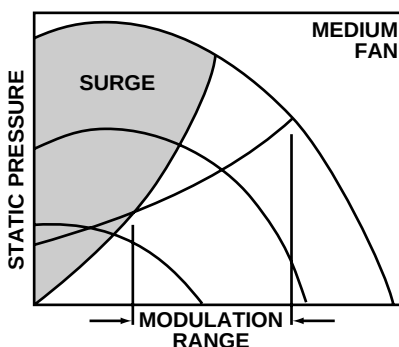
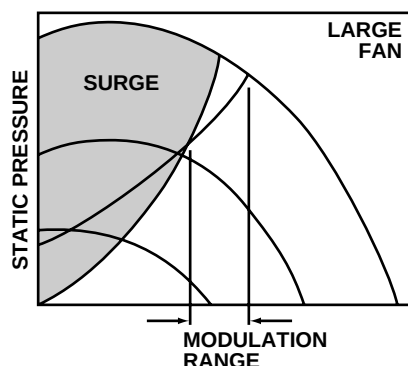
VARIABLE SPEED FANS

This method of air flow reduction should bring a reduction in BHP in a certain modulation range, providing the savings are not neutralized by the high initial cost and by the power consump-

tion of the variable speed drive. However, with such a device, selecting the most efficient fan for the job is nearly impossible because surge area is encountered rapidly, therefore reducing

the modulation range. This drawback forces the use of a smaller fan at lower efficiency (higher BHP) and higher noise level.

MODULATION RANGE WITH VARIABLE SPEED FANS



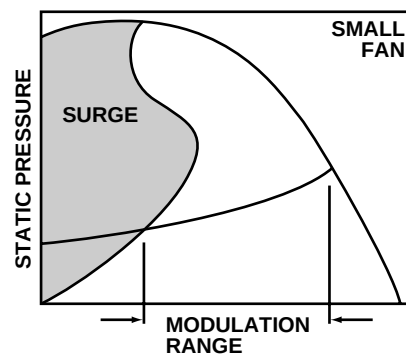
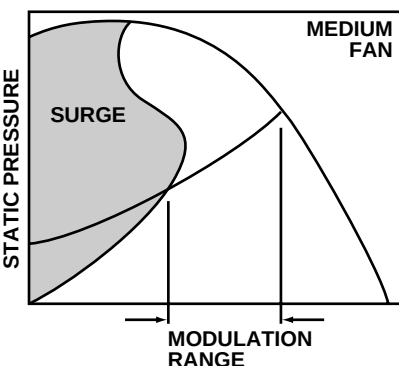
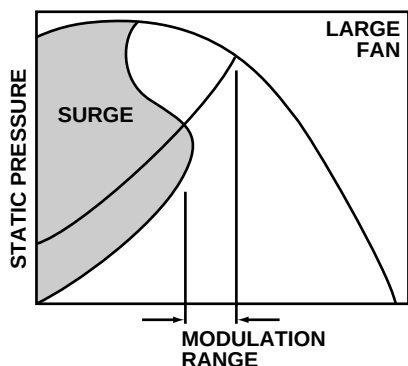
VARIABLE INLET VANES

The addition of a variable inlet vane increases the noise level of a centrifugal fan even when the most efficient one is selected. The surge area appears

rapidly with this most efficient fan, and the same compromise as with the variable speed fan is necessary, that is the selection of a smaller fan at higher speed

in order to obtain a reasonable modulation range. The disadvantages of the smaller fan are the same as with the variable speed drive.

MODULATION RANGE WITH INLET VANES



NOTE: A FAN SHOULD NEVER BE SELECTED OR ALLOWED TO OPERATE IN THE SURGE AREA (REFER TO ASHRAE TRANSACTIONS 1977 PART ONE).

PERFORMANCE

VARIMARK II

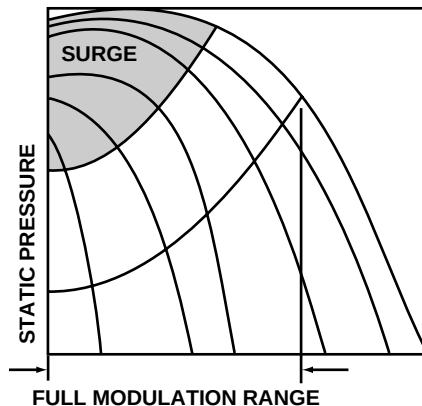
In calculating energy cost, knowing the utilization profile of the fan is of prime importance. When controlling a VAV system with a Varimark II, the fan is chosen directly from the fan curve catalogue. Maximum CFM published for a given fan curve represents 90% of WOCFM. No correction factor is required for RPM and BHP.

VARIMARK II

Because of the Varimark II principle, operation in the limited surge area will not occur, thus permitting selection of the large, most efficient and quiet fan with full modulation range.

Standard Varimark II permits fan operation in a stable area from maximum air flow rate down to full closure. In the fully closed position, the CFM leakage is 20%.

MODULATION RANGE WITH VARIMARK II



EXAMPLE:

Fan size: 36" BI - DWDI

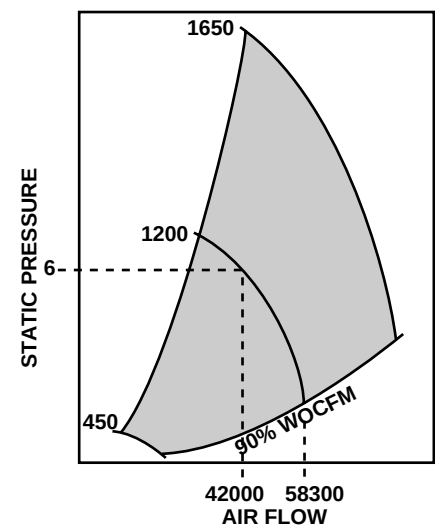
Max. req. CFM: 42000

SP: 6" max. - 1.5" min.

— Find CFM, SP and BHP at 75%, 50%, 25% and 12.5% openings of Varimark II.

1) On the fan performance curve, at 42000 CFM and 6" SP, read 1197 RPM and 55.7 BHP. At 90% WOCFM and 1197 RPM, this fan will deliver 58300 CFM.

FAN PERFORMANCE CURVE



2) Calculate ratio of maximum required CFM over 90% WOCFM:

$$\frac{\text{Max. req. CFM}}{90\% \text{ WOCFM}} = \frac{42000}{58300} = 72\%$$

PERFORMANCE

3) On fig. A, from the 72% point on the 90% WOCFM curve, draw a vertical line up to the 100% damper opening curve, and a horizontal line to read the equivalent maximum pressure: 75%.

4) Since the minimum required pressure is 1.5", using the rule of three, the equivalent minimum pressure will be:

$$\frac{1.5''}{6''} \times 75\% = 18.7\%$$

On fig. A, plot a system curve between the equivalent minimum pressure point (18.7%) on the SP scale and the operating point on the 100% damper opening curve.

5) We can now read pressure and flow percentages for each damper opening position:

% Opening	CFM	SP
100%	72%	75%
75%	67%	67%
50%	59%	55%
25%	46%	40%
12.5%	34%	30%

6) The 72% CFM and 75% SP obtained for the full damper opening represent 100% CFM and 100% SP for this system. Using the rule of three, translate the partial damper opening percentages of step no. 5 as follows:

Translate flow % =

$$\frac{100\% \times \text{Partial flow \%}}{\text{Max. flow \%}}$$

$$\frac{100\% \times 67\%}{72\%} = 93\%$$

and so forth

Translate pressure % =

$$\frac{100\% \times \text{Partial pressure \%}}{\text{Max. pressure \%}}$$

$$\frac{100\% \times 67\%}{75\%} = 89\%$$

and so forth

Therefore:

Damper opening	CFM	SP
100%	100%	100%
75%	93%	89%
50%	82%	73%
25%	64%	53%
12.5%	47%	40%

7) On fig. B, read the relative BHP using the relative CFM calculated in step 6.

Damper opening	CFM	BHP
100%	100%	100%
75%	93%	96%
50%	82%	89%
25%	64%	77%
12.5%	47%	63%

8) Apply the results of step 6 and 7 on 36" BI DWDI fan performance.

Damper opening	CFM	SP	BHP
100%	42000	6.0	55.7
75%	39000	5.3	53.4
50%	34400	4.4	49.5
25%	26900	3.2	42.9
12.5%	19700	2.4	35.1

FIGURE A

VARIMARK II PERFORMANCE

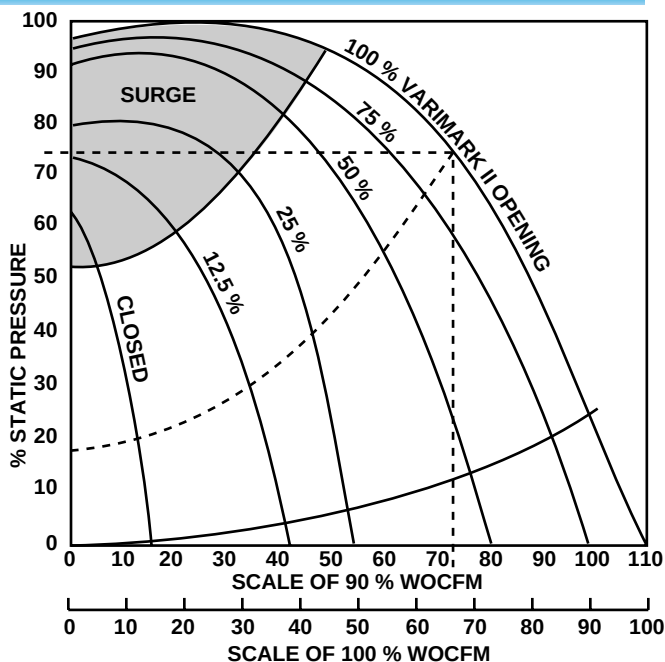
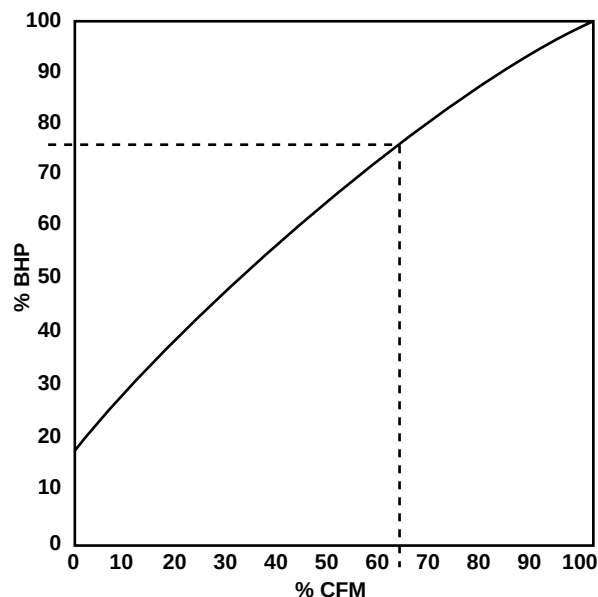


FIGURE B



CONTROLS

Controls are a very important part of a VAV system, and the choice of components is critical if maximum efficiency is to be obtained from all the elements of this system.

The following items should be chosen with particular care:

- Sensors: type (electric.... pneumatic), quantity and location. Generally speaking, sensor should be installed at 2/3 the length of duct work.
- Controller: accuracy, quantity.
- Pilot positioner: accuracy.
- Tubing (if pneumatic): length and size affect response time.
- Supply and return fans: should be controlled by the same sensor to cycle simultaneously.

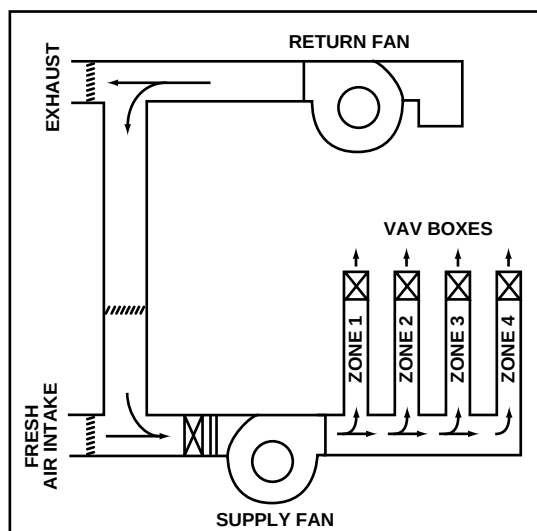
NOTE: — OUTPUT OF EACH ZONE SHOULD BE APPROXIMATELY THE SAME FOR GOOD MODULATION.

ALL VAV SYSTEMS HAVE THEIR PARTICULARITIES. THIS EXAMPLE IS ONLY GIVEN AS A GUIDE. FOR COMPLETE INFORMATION ON VAV CONTROLS, CONSULT YOUR CONTROL MANUFACTURER.

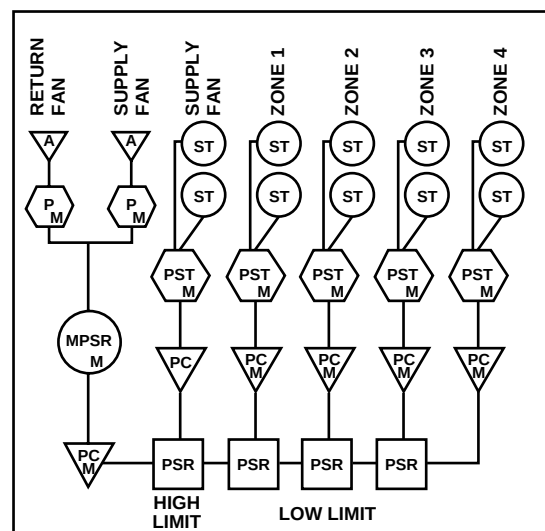
EXAMPLE OF VAV SYSTEM WITH CONTROLS

- A - Actuator pneumatic operator
- M - Main control air supply - 20 PSI
- MPSR - Minimum pressure selector relay
- P - Pilot positioner
- PC - Receiver controller
- PSR - Pressure selector relay
- PST - Pressure sensor transmitter
- ST - Pressure sensor

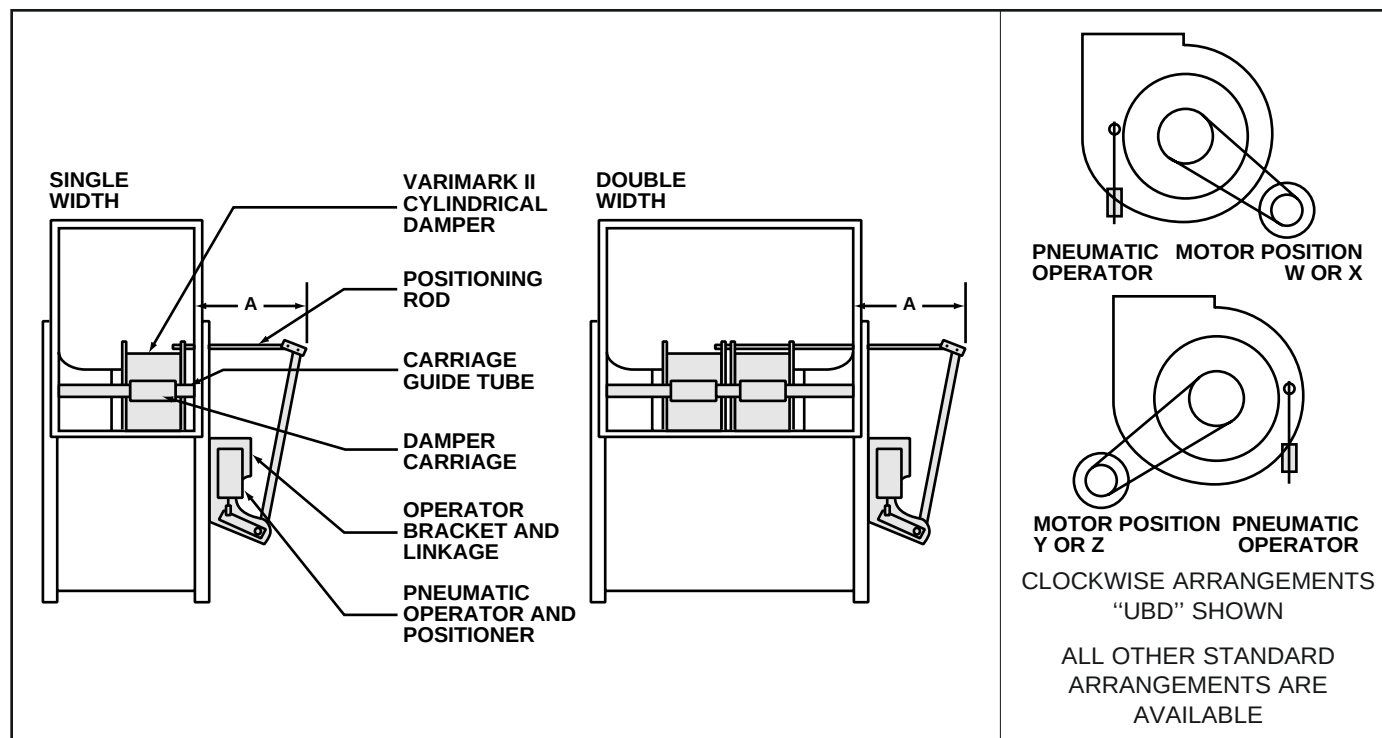
AIR SYSTEM



CONTROL SYSTEM



DIMENSIONS



SI DATA

UNIT NO.		12	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60	66	73
A mm		457	457	457	483	483	508	508	533	533	559	559	584	584	610	635	660	711	762	838
WEIGHT	SWSI kg	44	45	45	46	47	48	53	57	59	62	66	77	81	87	105	112	121	154	178
	DWDI kg	55	57	59	61	62	64	84	88	93	98	108	122	131	138	170	186	208	264	304

IMPERIAL DATA

UNIT NO.		12	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60	66	73
A inches		18	18	18	19	19	20	20	21	21	22	22	23	23	24	25	26	28	30	33
WEIGHT	SWSI lb	98	99	100	102	103	107	118	126	131	138	145	170	179	192	231	248	268	341	393
	DWDI lb	122	126	130	134	138	143	186	195	205	217	238	269	289	305	376	410	459	583	672

- 1) Pneumatic operator is always installed on electric motor side of fan casing except when specifications require operator installation on other side of casing.
On cabinet fans with electric motor outside cabinet, operator is always installed outside on cabinet, on electric motor side.
When electric motor is inside cabinet, operator is always installed inside, opposite side from electric motor.
- 2) Dimensions are as per current manufacture. Future changes may be shown on approval drawings only.
- 3) Varimark II weight includes all mechanism parts and pneumatic operator.

SPECIFICATIONS

GENERAL

The mechanical contractor shall furnish and install fans complete with Varimark II as shown on the plans. Fan specifications shall be as per centrifugal fan catalogue.

VARIMARK II CYLINDRICAL DAMPERS

On fans from 12" to 44" diameter, dampers shall be fabricated of sheet steel with reinforcing rings on both sides. On fans from 49" diameter and up, dampers shall be made of sheet aluminum alloy, reinforced by aluminum rings and cross channels.

DAMPER CARRIAGES

Dampers shall be supported by carriages on which shall be mounted 4 polyurethane rollers turning on permanently sealed and greased ball bearings. On fans 22" diameter and larger, lower roller shafts shall be adjustable.

CARRIAGE GUIDE TUBES

Damper carriages shall travel on electrically welded chrome plated guide tubes. On DWDI fans, 36" diameter and up, a reinforcing tube shall be added for each guide tube.

DRIVE MECHANISM

On DWDI fans, a positioning rod and a chrome plated rack and pinion mechanism shall operate the Varimark II dampers. The pinion shall rotate on an oil-impregnated bronze bushing and the mechanism shall be supported and protected by a steel housing.

On SWSI fans, a positioning rod shall operate the Varimark II damper.

PNEUMATIC OPERATOR BRACKET

The operator shall be mounted on a heavy gauge steel bracket designed to receive most makes. Operator action shall be transferred to the positioning rod through a lever mechanism mounted on a sealed flange ball bearing.

PNEUMATIC OPERATOR

Operator recommended by Rosemex Engineering Department shall be supplied complete with positive feed back positioner to control the Varimark II.

The control contractor shall provide 20 PSI main air line to the fan control system.



Products

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