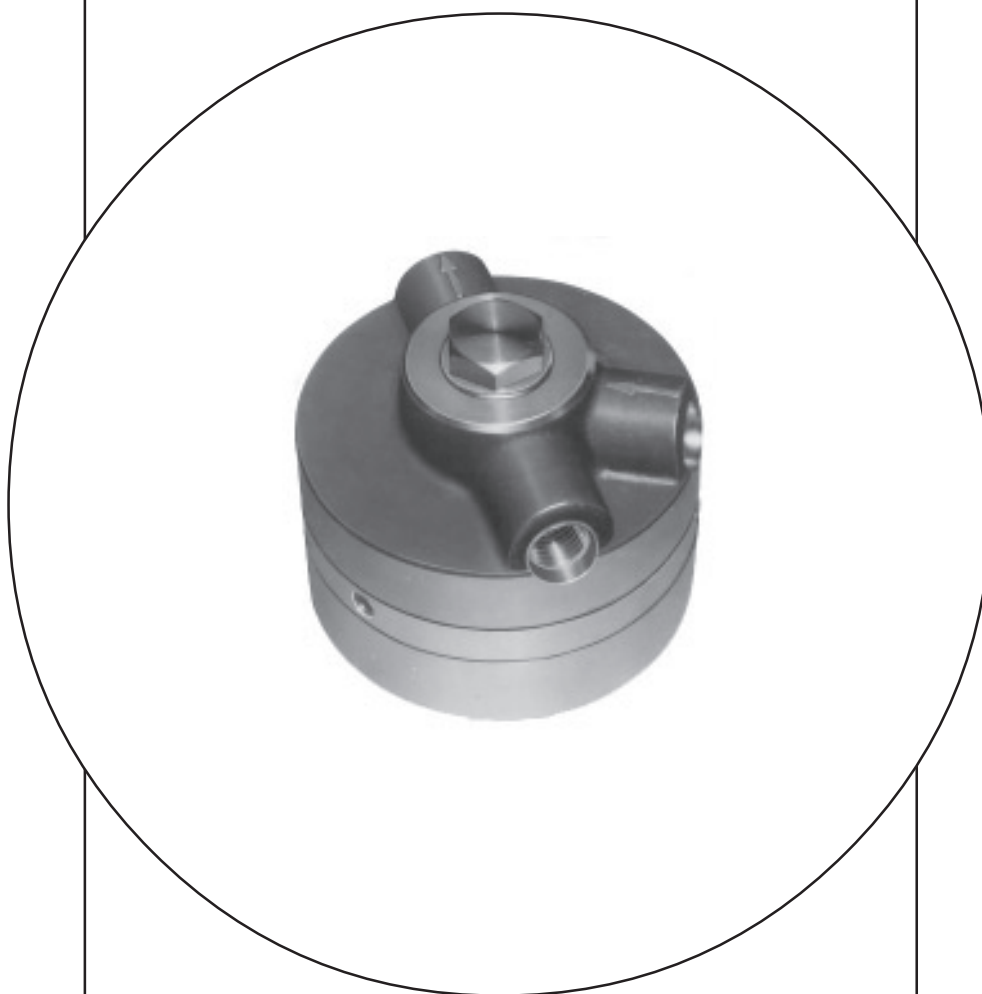


**Air Volume Booster  
Model : VF01**

**User's Manual**



Azbil Corporation

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# Air Volume Booster Model VF01

## 1. Overview

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The Air Volume Booster Model VF01 is essentially a large capacity pneumatic relay designed to improve the pneumatic operating speed of a valve actuator, resulting in reducing time lag. The booster is recommended for use when a pneumatic signal pressure from a controller has to be transmitted over an extremely long distance or a diaphragm actuator has a large capacity (Time lag is most likely to occur in such cases.). The Air Volume Booster is provided with a variable restriction. Application of a variable restriction will eliminate possible over-shootings and huntings, thus ensuring optimum response.

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## 2. Principle of Operation

### 2-1. Principle of Operation

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The following is the description of the principle of operation when the variable restriction ⑤ is fully closed.

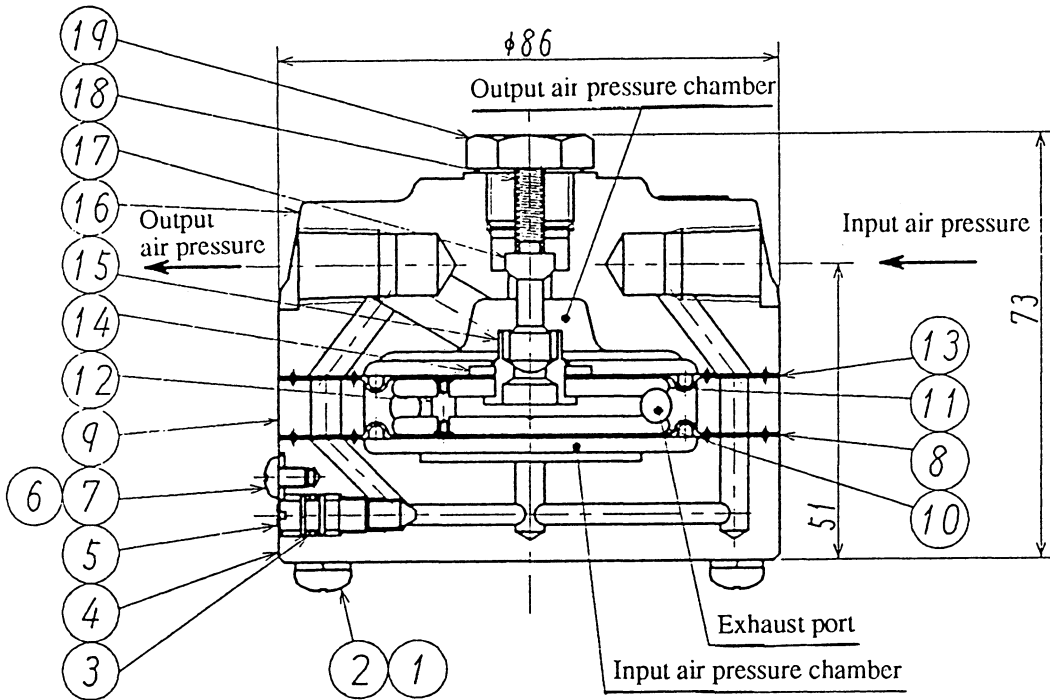
When the input air pressure increases, the air pressure in the input air pressure chamber increases to push diaphragm ⑧ upward. Diaphragms ⑧ and ⑬ move upward to close the exhaust port, and further, function to open the inlet port by pushing up a pilot valve ⑰. The air pressure is then supplied to the output air pressure chamber from the opened inlet port, and the output air pressure increases.

Since the effective areas of diaphragms ⑧ and ⑬ are the same, when the input and output air pressures become equal both the inlet and exhaust ports will be closed to keep the output air pressure and the input air pressure equal.

When the input air pressure lowers, the output air pressure is decreased by opening the exhaust port. Just as in cases where the input air pressure increases, when the input and output air pressures become equal, both the inlet and exhaust ports are closed to keep the output air pressure and the input air pressure equal.

Since the pilot valve ⑰ is designed to have a wide opening area, the pneumatic valve actuator can be operated immediately by either discharging or supplying a large quantity of air from or into the output air pressure chamber when a small amount of air flows into or out from the input air pressure chamber.

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KEY NO.	Description
①	Machine screw
②	Spring washer
③	"O" ring
④	Body (lower)
⑤	Variable restriction
⑥	Set screw
⑦	Plain washer
⑧	Diaphragm
⑨	Intermediate ring
⑩	Diaphragm plate
⑪	Diaphragm plate
⑫	Stay
⑬	Diaphragm
⑭	Washer
⑮	Valve seat
⑯	Body (upper)
⑰	Pilot valve
⑱	Spring
⑲	Cap screw

Figure 1 Air Volume Booster

## 2-2. Effect of Variable Restriction

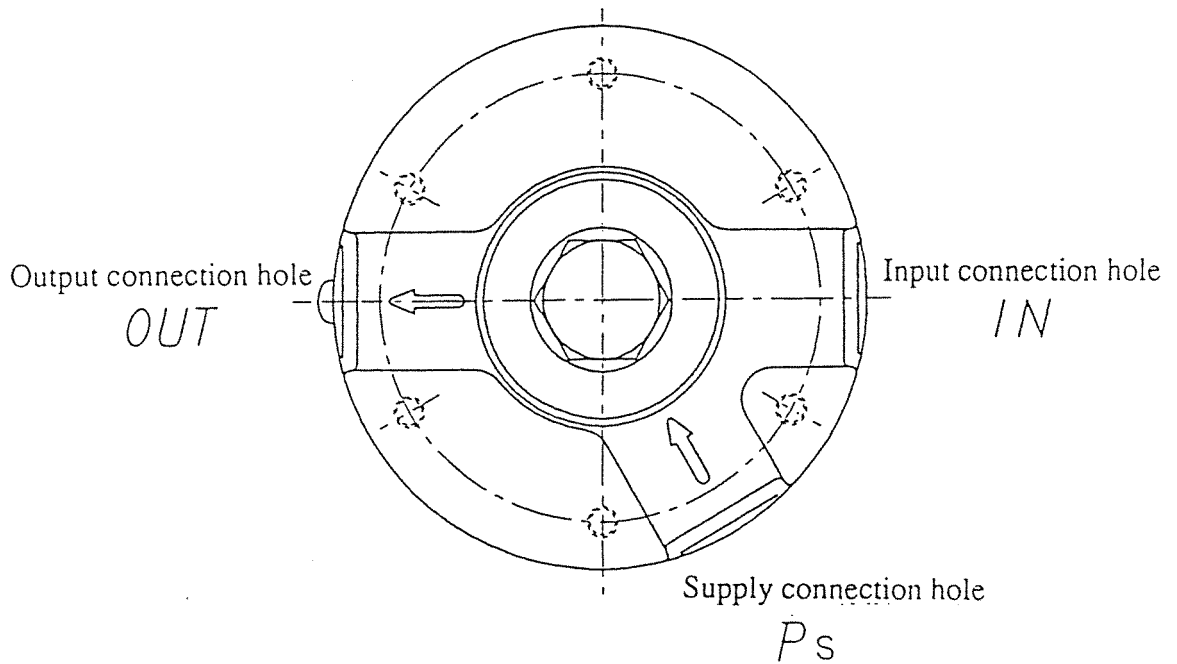
In cases where the mass of the moving element of the actuator is large, overshooting may occur if the operating speed is too fast. In addition, hunting may occur if a volume booster is inserted between the valve positioner and the valve actuator. However, this can be adjusted to stabilize operation by only slightly opening or closing the variable restriction ⑤ that is attached to the volume booster.

Since the variable restriction ⑤ is installed in the bypass circuit that connects the input air pressure chamber and the output air pressure chamber and restricts the air flow of the bypass circuit, the time constant on the input side and the output side of the volume booster can be changed by opening or closing this variable restriction ⑤. Therefore, optimum responsiveness can be obtained at all times regardless of the variable working conditions of the actuator.

### 3. Piping

This valve has three connection holes for piping. Each connection hole is marked with Ps, IN, and OUT, respectively. Ps is a connection hole for the supply air pressure. A maximum pressure of 690 kPa can be introduced. IN is a connection hole for input air pressure. OUT is a connection hole for output air pressure. Attention must be paid to these marks when piping is carried out.

All connection holes are Rc1/4 threads.



\* Piping connection: Rc1/4 thread

Figure 2. Piping Connection

### 4. Specifications

**Main materials:**

Body : Corrosion-resistance aluminum alloy, bronze

Diaphragm : Chloroprene rubber with fabric insert

Pilot section : SUS304

**Input air pressure:** 20 to 270 kPa

**Input to output air pressure ratio:** 1:1

**Supply air pressure:** 140 kPa (standard)  
690 kPa (maximum)

**Air consumption:** 1.5 NI/min.

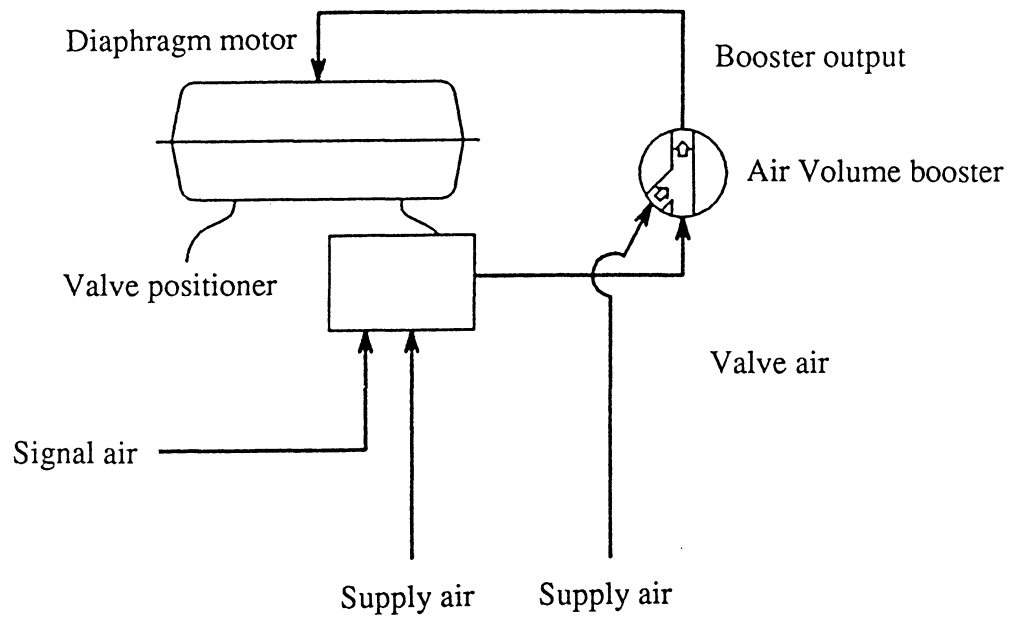
**Air handling capacity:** 140 NI/min. (supply air pressure: 140 kPa)

**Connection:** Rc1/4 thread

**Ambient temperature range:** -30 to +80°C

Speeds when Installed on Diaphragm Motor

Actuator Model No.	Stroke (mm)	Time required for full stroke (sec.)
HA1D, R	25	1.5
HA2D, R	38	3.0
HA3D, R	50	6.0



**Figure 3. Example of Piping Diagram**  
 (When an air volume booster is mounted on the diaphragm motor with positioner)

## 5. Assembly, Adjustment, and Disassembly

### 5-1. Assembly

Assembly		Remarks
a)	Set the O ring (3) on the variable restriction (5) and screw it in until it touches the lower section of the body (4). Then, screw the set screw (6) that is assembled with a plain washer (7) into the lower section of the body (4) and fix the variable restriction (5).	Apply silicone grease to the O ring (3).
b)	For positioning, pass the machine screw (1) that is set with a spring washer (2) through the lower section of the body (4). Place the diaphragm (8), intermediate ring (9), diaphragm assembly*1, and upper section of the body (16) on it and then tighten the machine screw (1).	*1. The diaphragm assembly consists of diaphragm (13), diaphragm plates (10), (11), stay (12), washer (14), and valve seat (15). Attention must be paid to the positions of the cut faces of diaphragms (8), (13) when diaphragm (8) and the diaphragm assembly are placed on the lower section of the body (4). Tighten the machine screws (1) evenly.
c)	When the assembly of the body is complete, gently put the pilot valve (17) at the center of the body and place the spring (18) on the seat of the pilot valve. Finally, set the cap screw (19).	

### 5-2. Adjustment

Adjustment		Remarks
a)	First, turn the variable restriction (5) clockwise to its extreme position to fully close the restriction.	
b)	Then, supply air and then actuate the volume booster.	
c)	If over-shooting or hunting occurs, adjust it by turning the variable restriction (5) counterclockwise little by little.	If the operation does not change even though the variable restriction (5) is turned, dust might have accumulated on the diaphragm section. Clean the working faces of the variable restriction (5) and the lower section of the body (4) by taking out the variable restriction (5). To take it out, first disconnect the equipment from the piping, remove the air, and unscrew the set screw (6). Then, take out the variable restriction (5) by turning it counterclockwise. Attention must be paid so as not to scratch the working faces of the head (tapered section) of the variable restriction (5) and the lower section of the body (4). If they are scratched, the adjustment effect is lowered considerably.
		If the operation becomes slow during working, remove the snap ring that is seen in the supply connection hole (SIG.), take out the filter, clean it, and reassemble it. The original operation speed will be obtained.

### 5-3. Disassembly

To disassemble, follow the assembly procedure in reverse.

*Note*





# Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products. You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

## 1. Warranty period and warranty scope

### 1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

### 1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

## 2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use  
Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down.  
You are required to provide your Equipment with safety design such as fool-proof design, \*1 and fail-safe design\*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance, \*3 fault tolerance,\*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

\*1. A design that is safe even if the user makes an error.

\*2. A design that is safe even if the device fails.

\*3. Avoidance of device failure by using highly reliable components, etc.

\*4. The use of redundancy.

## 3. Precautions and restrictions on application

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product.

However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

In addition,

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
  - \* Nuclear energy/radiation related facilities  
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
  - \* Machinery or equipment for space/sea bottom
  - \* Transportation equipment  
[Railway, aircraft, vessels, vehicle equipment, etc.]
  - \* Antidisaster/crime-prevention equipment

- \* Burning appliances
  - \* Electrothermal equipment
  - \* Amusement facilities
  - \* Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
  - (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
  - (5) Machinery or equipment that may affect human lives, human bodies or properties
  - (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety
4. Precautions against long-term use
 

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.
  5. Recommendation for renewal
 

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations. In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.
  6. Other precautions
 

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.
  7. Changes to specifications
 

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.
  8. Discontinuance of the supply of products/parts
 

Please note that the production of any Azbil Corporation's product may be discontinued without notice. For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.
  9. Scope of services
 

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

    - (1) Installation, adjustment, guidance, and attendance at a test run
    - (2) Maintenance, inspection, adjustment, and repair
    - (3) Technical guidance and technical education
    - (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.







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