

TORCAL

SOLIMAR

AIR KNOCKER SERIES

Instruction Manual



KNR-15-SS



KNR-20
KNR-20-SS



KNR-30 / KNR-40
KNR-30-SS / KNR-40-SS



KNR-60 / KNR-80
KNR-60-SS



KNR-100



KNR-30-DI / KNR-40-DI



KNR-60-DI / KNR-80-DI



KNR-100-DI

Safety Precautions

- The Air Knocker is designed to prevent materials from adhering to or blocking flow in process equipment by using forced air. Do not use the Air Knocker for any other purpose.
- Care has been taken to ensure the safety of the Knocker. Be sure to read this instruction manual and note the warning and caution messages before using the Knocker.
- The following symbols represent warning and caution messages to be observed when using the Knocker to prevent injury or damages to users or other persons.



WARNING

Refers to a hazard that may cause death or serious injury.



CAUTION

Refers to a hazard that may cause slight or medium injury.



WARNING

TO PREVENT DEATH:

- After installing the Knocker, make sure to attach the fall prevention wire to it to prevent it from falling due to percussion during operation.
- In the event that the Knocker falls, be sure to replace the fall prevention wire even if it appears to be undamaged.
- Do not connect the electric control devices (Knocker control board or three-way solenoid valve) for the Knocker to a power source which is not equipped with a breaker for preventing electric shock.



CAUTION





TO PREVENT INJURY OR DAMAGES:

- When removing the piping tube, please be sure to close the air supply from the control equipment and to release the air pressure which remains in the Knocker. If the tube is removed while air pressure still remains, the Knocker will operate, and there is a possibility of an unexpected injury.
- Securely weld Knocker base to the vessel so that the Knocker does not fall due to percussion during operation.
- If the vessel metal thickness is too thin, weld a reinforcing plate onto it to prevent the mount plate from being damaged as a result of impact during operations.

Introduction

- Be sure to read this instruction manual carefully before using the Klocker.
- Handle the Klocker appropriately and inspect it to maintain its performance.
- Keep this manual for future reference.

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Safety



CAUTION

FOR PERSONAL PROTECTION DURING OPERATION:

- Put on a safety helmet, safety boots, safety gloves and a safety belt, before any installation work is started.
- Conduct all required lock-out, tag-out or similar required procedures prior to inspection or repair.
- When using the fall prevention wire to prevent Klocker from falling, be sure to secure shackle with appropriate tie to prevent shackle screw from loosening from percussion during operation.



Safety
Helmet



Safety
Boots



Safety
Gloves



Safety
Belt



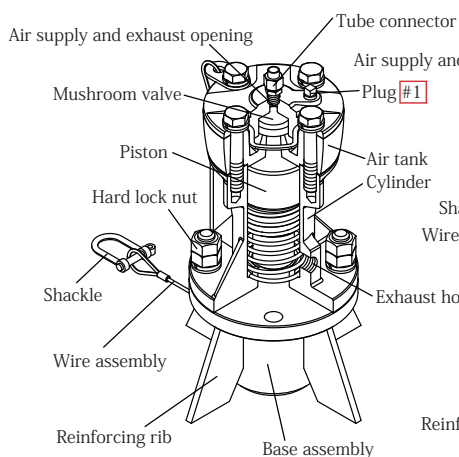
CAUTION

FOR LONGER SERVICE LIFE:

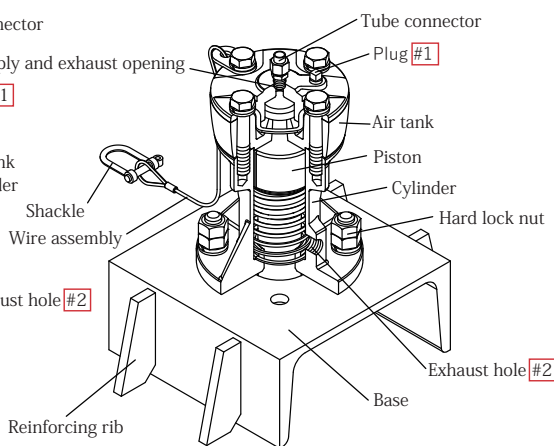
- When installing the air line, include a filter or filter/regulator prior to the Solenoid valve to minimize dust getting into the Solenoid valve, which may inhibit the Knocker from operating properly.
- Make sure the force of impact does not exceed the maximum level, as excessive impact may damage the vessel it is mounted on.
- When applying continuous impact at short cycles, allow an interval of at least one second. An interval of less than one second may lead to damage or operation problems.
- Only start air lines after checking that there is no foreign substance, chips, or slag on the piping materials.
- Flush with the air pressure of 44 psi or more, to clean any debris or contamination in the piping.
- Use air that passed through an air filter 5 micrometers or less. Moisture or dust in line will potentially cause poor operation and air leakage.
- The line should connect to the IN side in the direction of the flow and to the IN port displayed on the product.
- Do not use in an area with corrosive explosive gas.
- When using a sealant, be careful to keep from inside the line, and seal to prevent external leaks. When wrapping sealing tape around the screw part, wrap the tip of the screws leaving 2 to 3 threads. Also, when using a liquid sealant, coat leaving 2 to 3 threads. Do not coat the female screws of the equipment. Tighten and check for air leaks.
- In cold areas, please protect against freezing. (Air should not freeze)
- Avoid placing a heavy load on the lines.
- Operation air should contain some moisture or light oil. Operating using dry air may shorten the product's life cycle.

Names of Parts

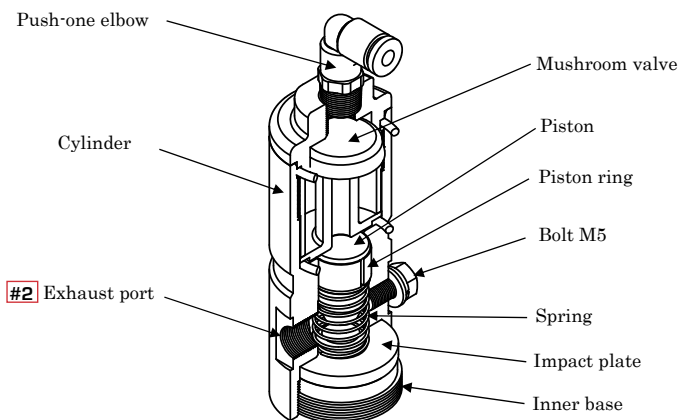
KNR Models



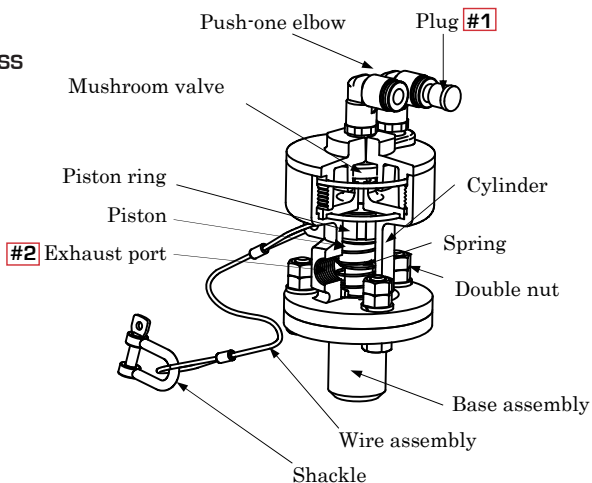
KNR-DI Models



KNR-15-SS



KNR-20 KNR-20-SS

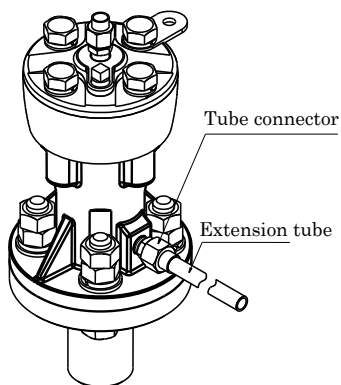


#1 Using relay piping, remove the blank plug and insert a relay piping tube in the outlet.

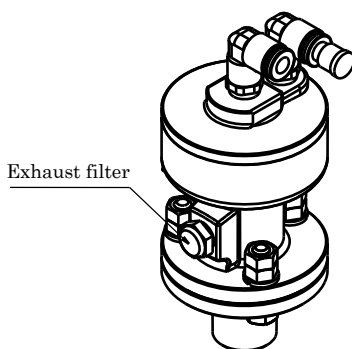
#2 When using a Knocker where exhaust air must be directed away from installation site, please screw a tube connector into the Knocker's exhaust hole, and make exhaust air discharge outside with an extension tube. A sintered metal exhaust filter may also be used.

Extension Tube / Tube Connector Option

Model (KNR-)	Dia. of Exhaust Hole Screw	I.D. of Recommended Tube	Max. Distance of Extension Tube
15-SS	1/8 NPT	1/4"	130 ft.
20 / 20-SS	1/8 NPT	1/4"	130 ft.
30 / 30-DI / 30-SS	1/4 NPT	5/16"	130 ft.
40 / 40-DI / 40-SS			
60 / 60-DI / 60-SS	3/8 NPT	3/8"	130 ft.
80 / 80-DI	1/2 NPT	1/2"	130 ft.
100 / 100-DI	3/4 NPT	1/2"	130 ft.



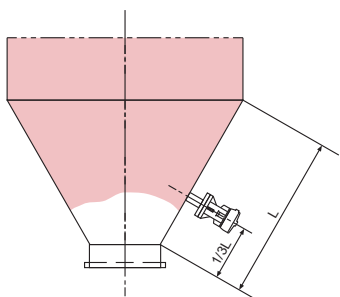
When Discharge Exhaust Outside



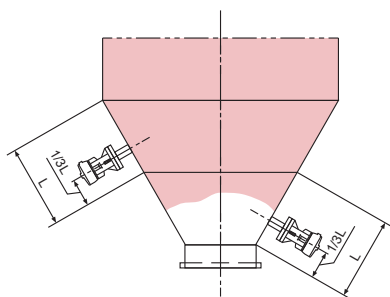
When Use Exhaust Filter

Installation

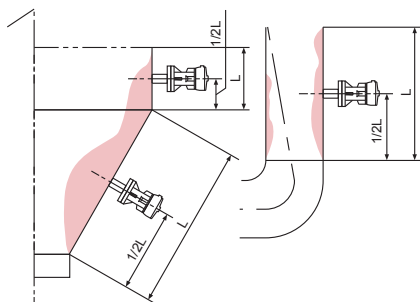
1. INSTALLING POSITION



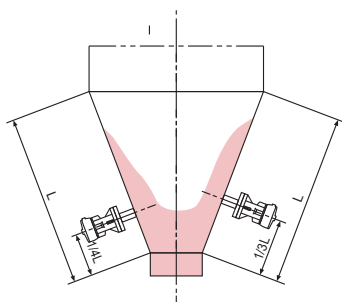
For small cone, pyramid hopper.



For large cone, pyramid hopper.



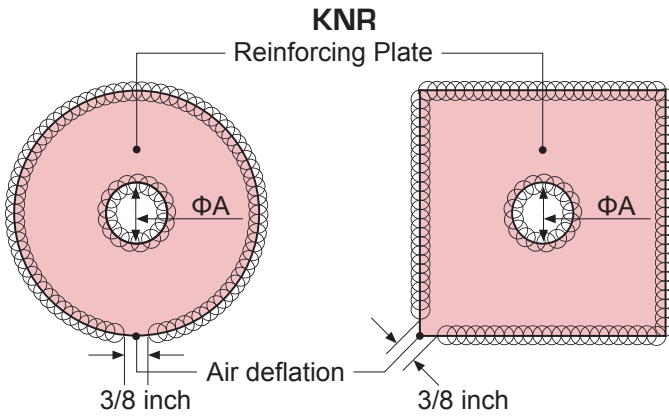
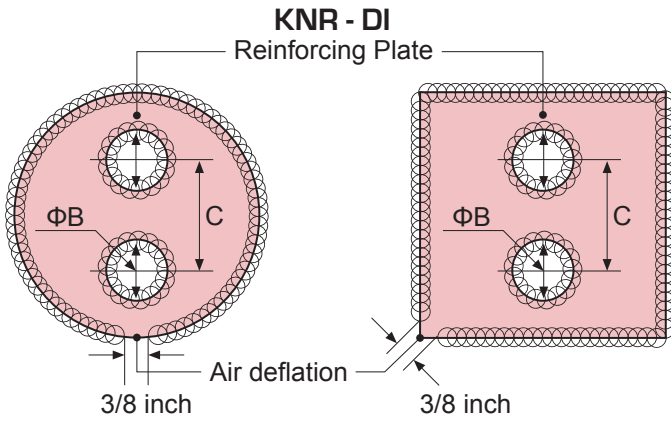
In case of clinging on the surface of wall and the inside pipe.



In case of bad fluid materials.

2. WELDING THE REINFORCING PLATE:

- If the vessel wall thickness is too thin, weld a reinforcing plate onto it. Welding procedure should use all-around welding so that no gap arises between the vessel and the reinforcing plate. Leave one spot unwelded for bleeding air. If no spot is left unwelded for bleeding the air, the air creates a cushion, dampening the effect of impact.
- A large impact force is transferred to the reinforcing plate at the time of operation. In order to avoid failure, install as instructed.



Welding

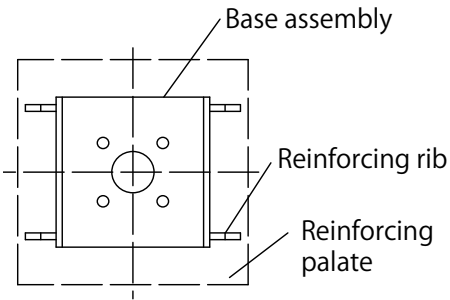
Reinforcing Plate Size [inches]

Model (KNR-)	Square Type	Round Type	ΦA	ΦB	C
30 / 30-SS / 30-DI	□6 × t1/8	Φ6 × t1/8	5/8	3/4	2
40 / 40-SS / 40-DI	□8 × t1/8	Φ8 × t1/8			3
60 / 60-SS / 60-DI	□12 × t3/8	Φ12 × t3/8	2		3 1/2
80 / 80-DI	□16 × t3/8	Φ16 × t3/8		1	4 3/4
100 / 100-DI	□20 × t1/4	Φ20 × t1/4	3 3/8		5 1/2

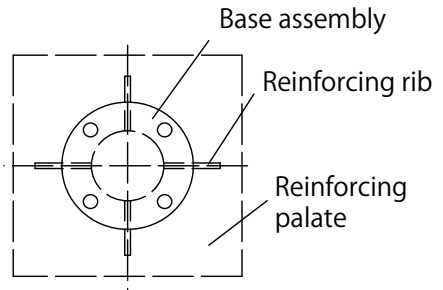
3. WELDING THE BASE ASSEMBLY AND REINFORCING RIB:

- Cut the reinforcing rib to match the configuration of the part to which it is to be mounted.
- Orient the holes in the base so that exhaust port of Knocker faces downward.
- Use all-around welding to weld the base assembly and make sure that the bolt holes on the right and left sides are symmetrical.

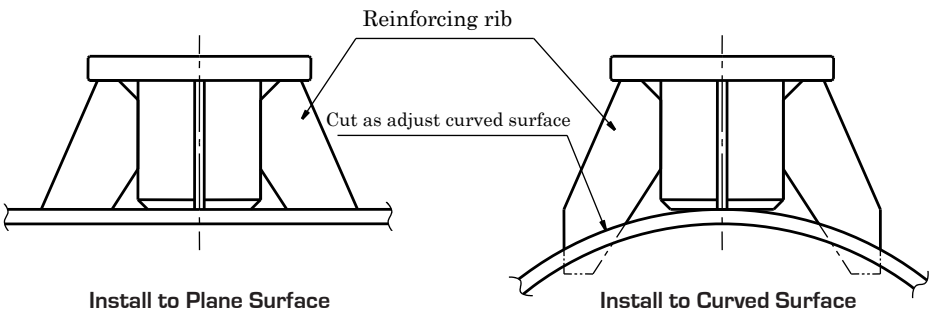
KNR-DI Models



KNR Models

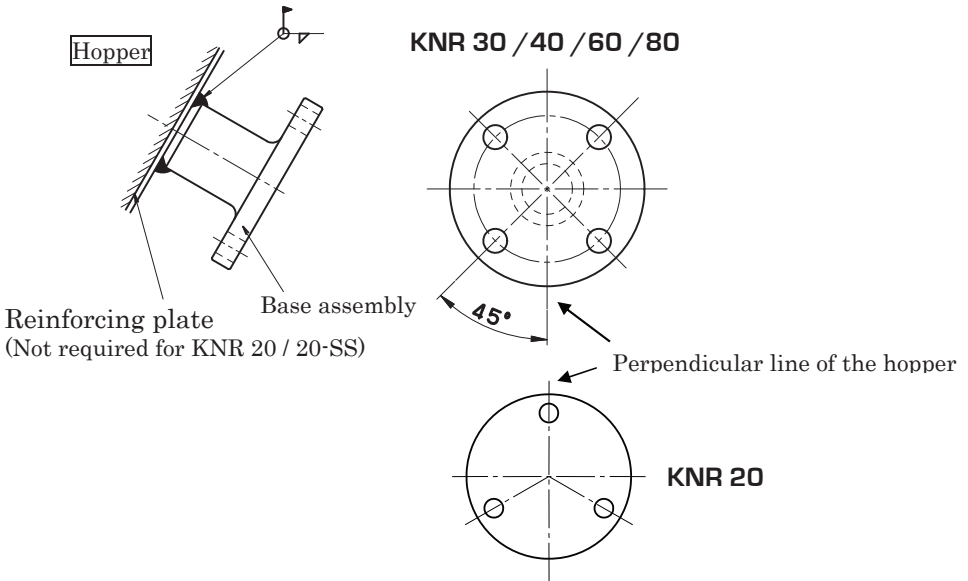


KNR Model: Install Reinforcing Rib



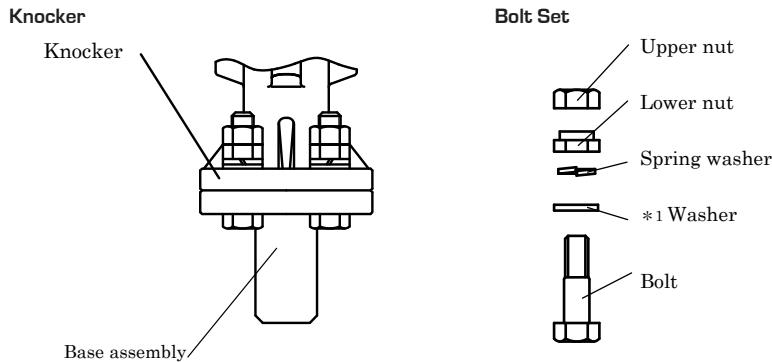
ORIENTATION BASE ASSEMBLY

Please make sure that the holes in the vessel and the base are correct so that the exhaust port of the Knocker faces downward.



4. MOUNTING THE KNOCKER:

When attaching Knocker unit and base with bolt set, pay attention to the torque to prevent loosening by the impact of the Knocker.



* The washer is not attached to KNR-20 / KNR-20-SS.
The bolt set is unnecessary in KNR-15-SS.

Clamp Torque Nut Size

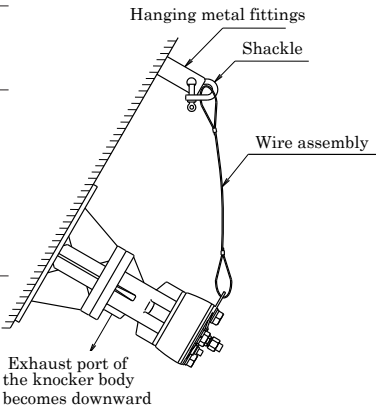
Model (KNR-)		20	30	40	60	80	100
Nut Size		M6	M8	M12	M14	M16	M20
Tightening Torque (lbf • ft)	Lower Nut	4.0	8.0	26.0	42.0	62.0	123.0
	Upper Nut	4.0	6.0	18.0	29.0	44.0	86.0

- To prevent falling, suspend the Knocker by the wire and the shackle.
- Adjust the position of the metal fittings so that the wire assembly does not loosen.

Wire Assembly

Model (KNR-)	Wire Diameter	Wire Length	Shackle
15-SS	1/16	12	5/32
20 / 20-SS		6	
30 / 30-DI / 30-SS	3/32	7	1/4
40 / 40-DI / 40-SS		14	
60 / 60-DI / 60-SS	1/8	17	
80 / 80-DI			
100 / 100-DI	3/16	20	5/16

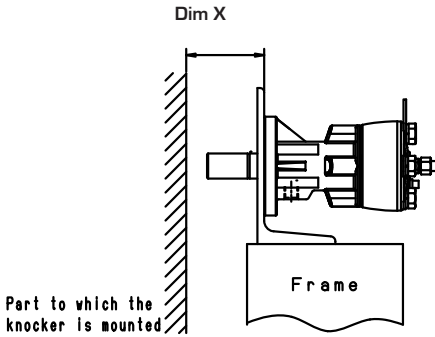
(inches)



* The fall prevention wire is an option. (KNR 15-SS)

5. PRESCRIBED DIMENSIONS FOR THE KNR-DI MODEL MOUNTING:

If not using the base assembly provided, make sure that the dimensions of the part to which the Knocker is mounted and the base mounting part meet the prescribed dimensions listed below.



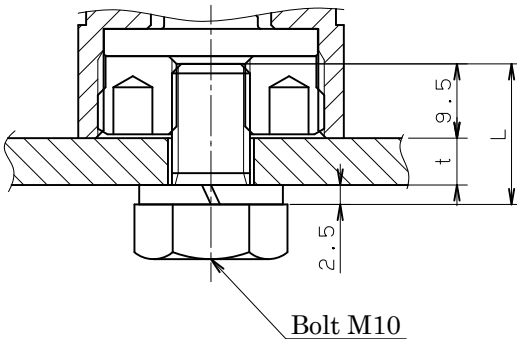
Prescribed Dimensions

Prescribed Dimensions

Model [KNR-]	Dim X	(inches)
30-DI	2	
40-DI	3	
60-DI	3.5	
80-DI		
100-DI		

KNR-15-SS:

- The KNR-15-SS type uses M10 bolts.
- Please strictly observe the torque specs for bolts.
- Bolt size and material: M10 SUS or M10 SS
- Clamp torque: 12.5 lb•ft•



L: length of bolt t: thickness of plate

An additional washer with thickness of at least 2mm must be used with wall thickness less than 2mm

Effective Length: 9.5mm

t (mm)	L
Less than 4mm ¹	M10 × 14
From 4 to less than 6	M10 × 16
From 6 to less than 8	M10 × 18

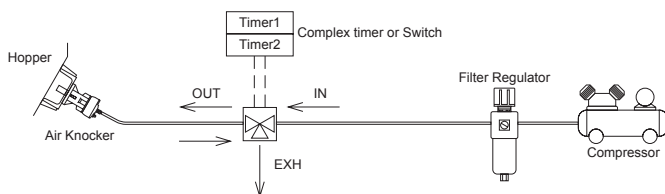
Piping

- Select either standard or relay system piping per the examples below.
- When only one system is used with the control board (HKA and EKE models), place a blind stopper in the unused system.
- In the control board (HKA and EKE models), the Knocker can be connected to line A or line B, but note that the pressure accumulation and percussion operations are reversed on one system.

1. EXAMPLE IN STANDARD PIPING: A/B/C

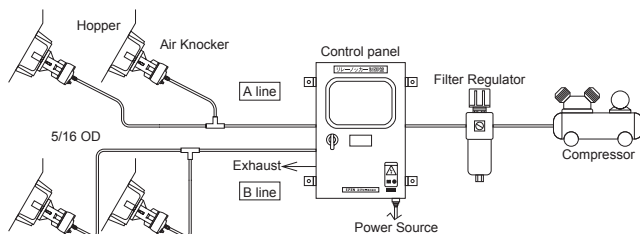
A. When using a three-way solenoid valve:

■ When using with three-way solenoid valve



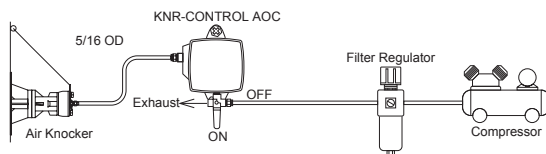
B. When using the HKA and EKE model exclusive control board:

■ When using the HKA, EKE exclusive control panel



C. When using the air operation controller KNR-CONTROL AOC model:

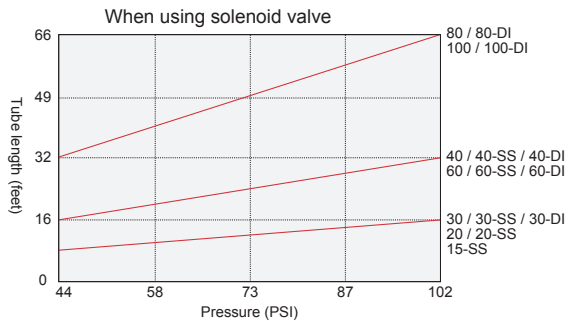
■ When using the air operation controller KNR-CONTROL AOC



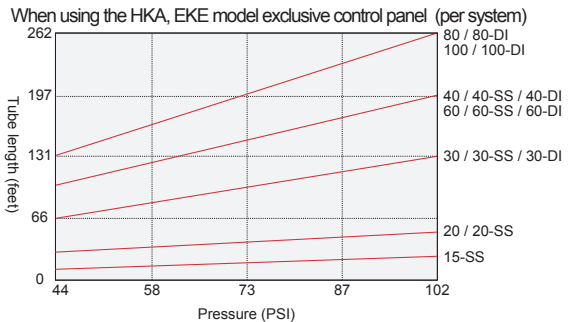
2. TUBE LENGTH IN STANDARD PIPING

- Make air lines as short as possible to maximize the impact force.
- The maximum length of a piping tube changes with model, air pressure, and control unit, and may decrease Knocker effectiveness by 10 to 20%.
- When adding another pipe, the length of the tube from the branch point to each Knocker should be equal.
- Avoid extreme bending and adding extra lines. It may affect operation and impact force especially in units furthest from the air supply.
- It is recommended to set the minimum tube pressure at 44 psi to maintain stable performance. Impact force can be maintained by increasing air pressure.
- When arranging the piping between the Knocker and the control devices, use nylon or urethane tube which has a OD of 5/ 16 in.

A. When using the solenoid valve:



B. When using the HKA and EKE model exclusive control board (per system):

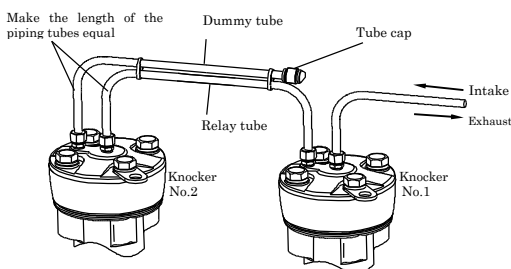


C. Maximum Tube Length (ft) between KNR-CONTROL AOC and Knocker:

Model (KNR-)	Tube Length (ft)
15-SS / 15	6.5
20 / 20-SS / 20	6.5
30 / 30-SS / 30-DI	6.5
40 / 40-SS / 40-DI	9.75
60 / 60-SS / 60-DI	26.25
80 / 80-DI	32.75
100 / 100-DI	

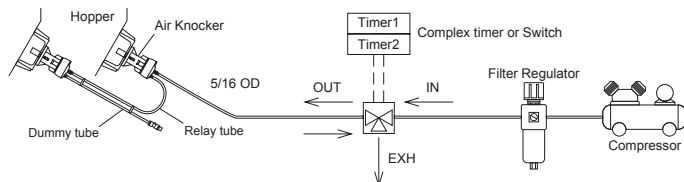
3. EXAMPLE IN RELAY SYSTEM PIPING: D/E/F

- Relay system piping method that connects two or more Knockers in series. This method is connecting a relay tube from air tank of the Knocker (cross valve side) to air supply and exhaust opening of another Knocker.
- When using relay system piping, Knocking action starts in order from a Knocker that is located in cross valve side to other Knockers. The maximum number of Knocker that can be used is regulated by the type of control.
- When arranging relay piping, please set the actuation of the solenoid valve at 1 second or more. When the tube length of relay piping becomes long and/or the number of relay pipes increase, please extend actuation of the solenoid valve.



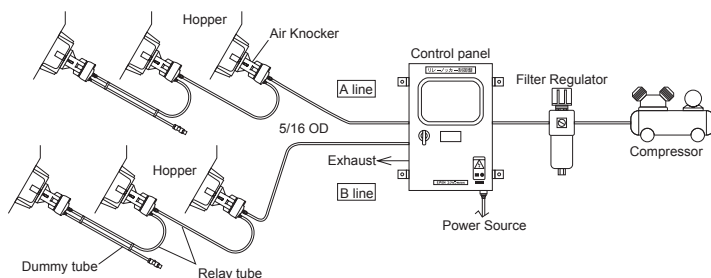
D. When using the three-way solenoid valve model (maximum 5 units):

■ When using with three-way solenoid valve



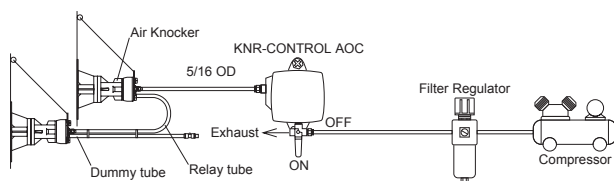
E. When using the HKA and EKE model exclusive control board (maximum 10 units per system):

■ When using the HKA, EKE exclusive control panel



F. When using the air operation controller KNR-CONTROL AOC model (maximum 3 units):

■ When using the air operation controller KNR-CONTROL AOC



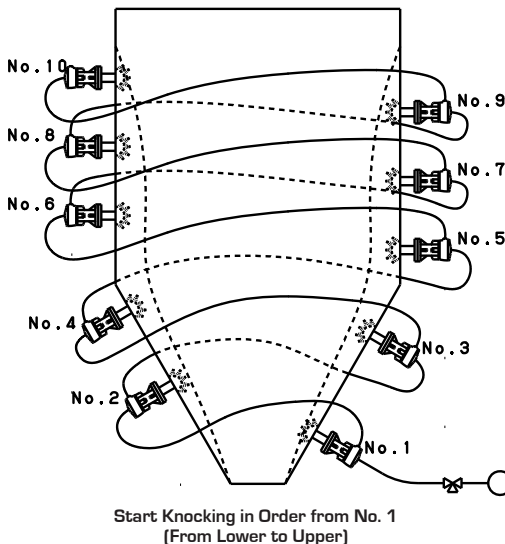
4. TUBE LENGTH OF RELAY SYSTEM PIPING AND AIR PRESSURE

- In relay system piping, compressed air in the relay tube is also used for operation air of the Klocker. Accordingly, the air pressure is not to exceed the regulated valve. (Refer to length of relay tube in relay system piping and air pressure)
- Use 5/16 OD nylon or urethane tube when arrange piping between Knockers and control equipment. (Please use 1/4 OD tube for KNR-20.)
- Arrange tube length to the first Klocker as referenced in standard piping, section 2.
- It is recommended to connect a piece of dummy tube (that is same length as the relay tube) to the terminal Klocker, so the knocking force of every Klocker is equal. (Refer to Section 3. Example of relay system piping - pg. 13)
- In order to prevent an air leak, please equip the end of the dummy tube with a cap.
- In relay system piping, the knocking force increases when the tube length is extended but it will effect the durability of the Klocker unit.
- Length of connecting tube (relay tube) for 2nd and other Knockers are dependent on the type of Klocker. Length between is not to exceed the maximum length. Also, make the length as even as possible to balance knocking force. (Refer to table) ▼

Length of Relay Tube in Relay System Piping and Air Pressure

Model (KNR-)	Relay Tube Length (ft)	Working Pressure (PSI)
20 / 20-SS / 20	3.25 or less	44 or above
30 / 30-SS / 30-DI	3.25 or less	44 or above
40 / 40-SS / 40-DI	16.5 or less	58 or above
60 / 60-SS / 60-DI	16.5 or less	73 or above
80 / 80-DI	32.75 or less	73 or above
100 / 100-DI	32.75 or less	80 or above

Knocking force at value listed above is equivalent to the knocking force at maximum air pressure (102 psi) in standard piping



Test Operation and Settings Before Use

After mounting and piping the Knocker, run a test operation and complete the settings in accordance with the following procedure:

1. Set the air pressure to 44 psi. [14.5 psi at relay piping]
2. Set the most suitable air pressure in the regulated range by increasing the air pressure of the regulator 5 psi apiece.

Note: The farther the Knocker is from the regulator, the lower the pressure at the Knocker compared to the pressure indicated at the regulator. In such a configuration, set the pressure slightly higher.

Inspection

Inspect the following items at least once every three months to minimize trouble during operation:

1. Are any nuts or bolts loose?
2. Are any welded parts cracked?
3. Have any contaminants gotten into the Knocker?
4. Is there any abnormal wear on the cylinders or pistons?
5. Is there any spring damage?
6. Is there any damage to safety wire assembly?

Replacement Period For Consumables

Replace consumables as set out in the following table:

Part	How to determine the replacement period from visual and audible signs	Replacement Period (Average)
Mushroom Valve	Determine according to the amount of wear, scratches and cracks (visual)	1,000,000 Strokes
Piston	Determine according to the amount of wear (visual)	1,000,000 Strokes
Spring	Determine according to the amount of wear and operation conditions (Visual and audible)	1,000,000 Strokes
Spring	Determine according to the amount of wear and operation conditions (Visual and audible)	1,000,000 Strokes
Impact plate (KNR-15-SS)	Judge in the wear condition of the tip part (visual)	500,000 strokes

Note: Contact the branch, sales office or designated service center closest to you for repair or overhauling of the Knocker

Troubleshooting

Simple diagnosis by checking audible and visual signs and signs detectable by touch.

Phenomenon	Sign	Cause	Action
Chatter	Low Impulsive Force	The air pressure is low	Increase the air pressure
		The three-way valve is defective	Repair or replace the valve
		The spring is damaged	Replace the spring
		Foreign matter has got into the cylinder	Clean the cylinder
No Percussion	No Percussion	The air pressure is low	Increase the air pressure
		The three-way valve is defective	Repair or replace the valve
		The spring is damaged	Replace the spring
		Foreign matter has got into the cylinder	Clean the cylinder
		The tube is bent	Improve the piping
		The tube is too long	Improve the piping
		The cylinder is worn	Replace the cylinder
		The piston is worn	Replace the piston
		The mushroom valve is worn or damaged	Replace the mushroom valve

Specifications

List of Models:

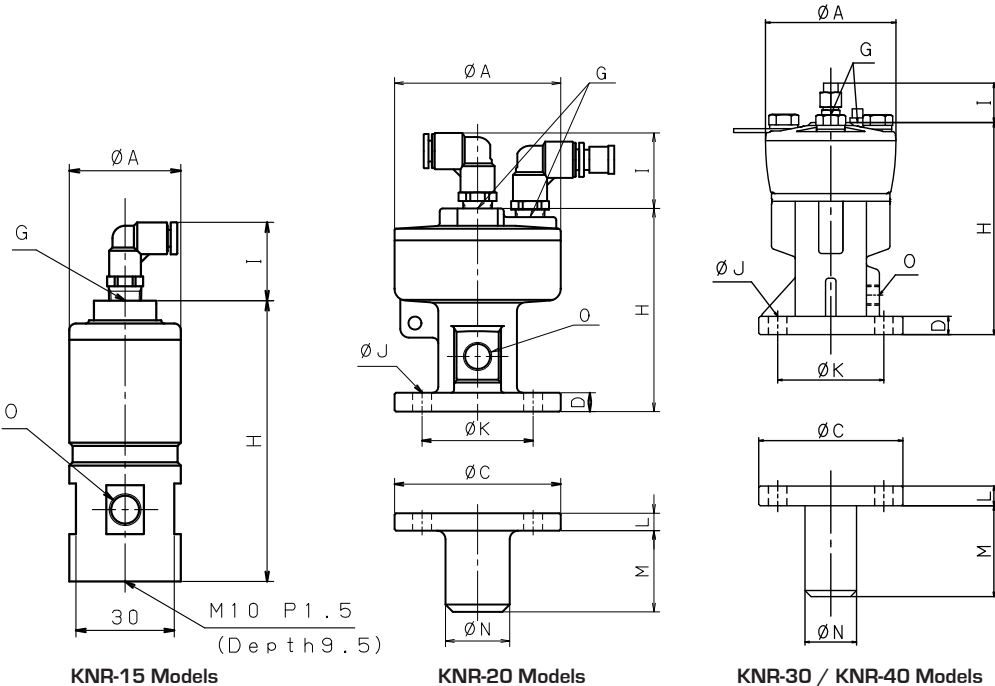
Model (KNR-)	Working Pressure (PSI)	Stroke Cycle (cycle/ min)	Air Consumption (cf/ cycle)	Stroke Energy (lbf • ft)	Impulsive Force		Weight (lb)*
					ft • lbf/s	Converts into Hammer pound (lb)	
15-SS	44 - 102	1 - 60	0.001 - 0.002	2.0 - 4.6	2.2 - 3.6	Below 0.4	0.95
20 / 20-SS			0.001 - 0.004	3.2 - 6.1	4.3 - 5.8	Below 0.6	1.8
30 / 30-SS			0.002 - 0.005	4.1 - 9.7	8.7 - 13.0	Below 1.0	3.1
40 / 40-SS			0.005 - 0.013	6.8 - 16.4	18.8 - 28.9	1.0 - 1.5	7.7
60 / 60-SS			0.012 - 0.027	15.2 - 36.1	49.9 - 76.7	1.5 - 3.0	20.5
80			0.021 - 0.049	33.3 - 80.4	109.9 - 171.4	3.0 - 8.0	32.0
100			0.034 - 0.080	60.8 - 148.3	217.0 - 339.2	6.0 - 15.0	75.1
30-DI			0.002 - 0.005	4.1 - 9.7	8.7 - 13.0	Below 1.0	4.6
40-DI			0.005 - 0.013	6.8 - 16.4	18.8 - 28.9	1.0 - 1.5	12.3
60-DI			0.012 - 0.027	15.2 - 36.1	49.9 - 76.7	1.5 - 3.0	28.9
80-DI			0.021 - 0.049	33.3 - 80.4	109.9 - 171.4	3.0 - 8.0	40.6
100-DI			0.034 - 0.080	60.8 - 148.3	217.0 - 339.2	6.0 - 15.0	78.3

*Weight includes base.

Dimensions

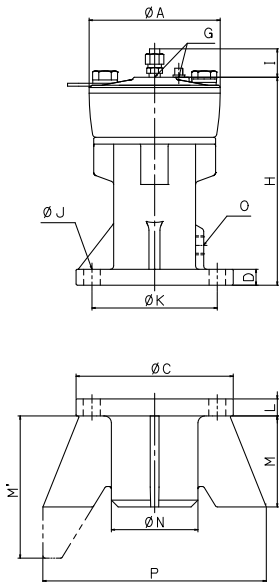
(inches)

Model (KNR-)	ΦA	ΦC	D	ΦE	F	G	H	I	ΦJ
15-SS	1.34	--	--	--	--	1/8" NPT	3.39	[.94]	--
20 / 20-SS	2.25	2.25	0.25	-	-		2.75	[1.02]	0.25
30 / 30-SS	2.59	2.75	0.31	-	-		3.73	[0.98]	0.33
40 / 40-SS	3.39	3.73	0.47	-	-		5.52		0.48
60 / 60-SS	4.53	5.44	0.55	-	-		7.2		0.58
80 / 80-SS	5.75	5.83	0.63	-	-	1/4" NPT	8.73	[1.11]	0.67
100	6.89	8.19	0.78	-	-		10.63		0.83
30-DI	2.59	2.75	0.31	0.59	1.5	1/8" NPT	3.73	[0.98]	0.33
40-DI	3.39	3.73	0.47	0.92	2.17		5.52		0.48
60-DI	4.53	5.44	0.55	1.38	2.56		7.2		0.58
80-DI	5.75	5.83	0.63	1.88	2.36	1/4" NPT	8.73	[1.11]	0.67
100-DI	6.89	8.19	0.78	2.14	1.97		10.63		0.83

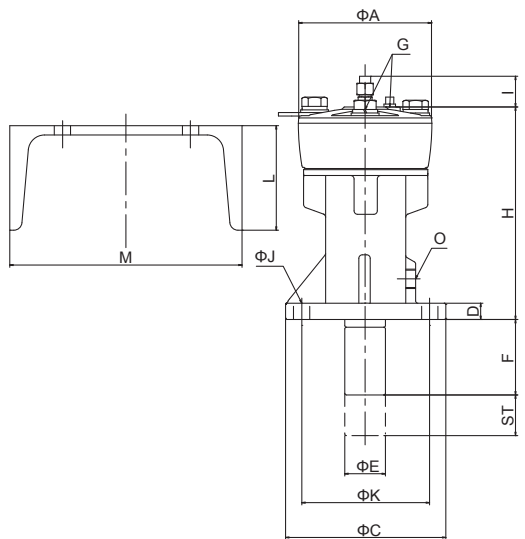


M" means curve
surface
dimension

ΦK	ST	L	M	M"	ΦN	O	W	Tube Size	
--	--	--	--	--	--	1/8" NPT	--	Φ1/4 × Φ1/8	
1.73	-	0.23	1.11	-	0.86		-	Φ1/4 × Φ1/8	
2.17	-	0.31	1.38	-	1.09	1/4" NPT		Φ5/16 × Φ1/4	
2.75	-	0.52	2.36	-	1.34				
4.33	-	0.59	3.16	4.72	3	3/8" NPT	7.72		
4.72	-	0.7	3.55	4.53	3	1/2" NPT	8.5		
6.69	-	0.91	4.53	5.31	4.5	3/4" NPT	12.13		
2.17	0.67	1.97	3.94	-	-	1/4" NPT	-		
2.75	0.98	2.95	5.91			3/8" NPT			
4.33	1.38	3.55	7.88						1/2" NPT
4.72	1.58								
6.69	1.97								



KNR-60/80/100 Models



KNR-DI Models



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