

# Yamada

## Understanding Diaphragm Failures

Failure types and what they tell you



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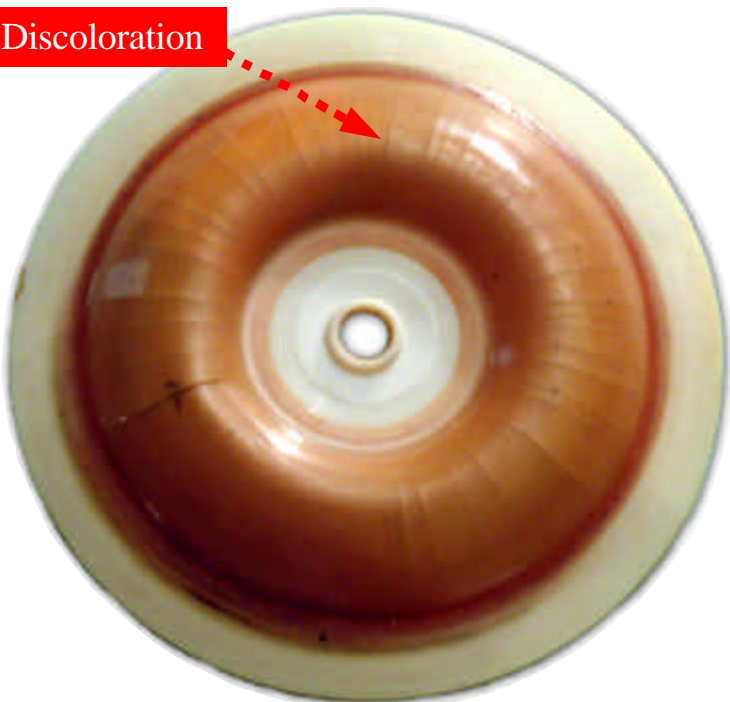
Yamada America, Inc.  
1200 Nuclear Drive  
West Chicago, IL 60185  
800-990-7867

# Diaphragm Failures:

Failure types and what they tell you.

## Excessive Heat or Chemical Attack

Discoloration



Cracking



You will notice *bubbling, cracking or discoloration of the diaphragm* in which material of the diaphragm could be so bad it pulls away from it's internal lining. This situation can be avoided by reviewing the application to find a better material.

Bubbling



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# Diaphragm Failures: Failure types and what they tell you.

## Excessive Suction side Pressure

Air Side Wear Marks



Diaphragms will *appear to be imploded and miss-shaped with very short diaphragm lives*. Rubbing of the diaphragm on the air chamber may also be apparent in extreme cases. This would be evident by wear marks around the outer edge of the diaphragm on its airside. One needs to remember that the rubber fitted diaphragms can handle up to 40psi inlet while the Teflon diaphragms will only handle about 4psi. High inlet pressures cause this and or the cleaning process the pump may undergo (ex. with city water pressure). Dampening the inlet of the pump and/or consulting the factory for tricks on how to help with inlet pressure are highly recommended for this situation.



Imploded Air Side

# Diaphragm Failures: Failure types and what they tell you.

## Over Torque

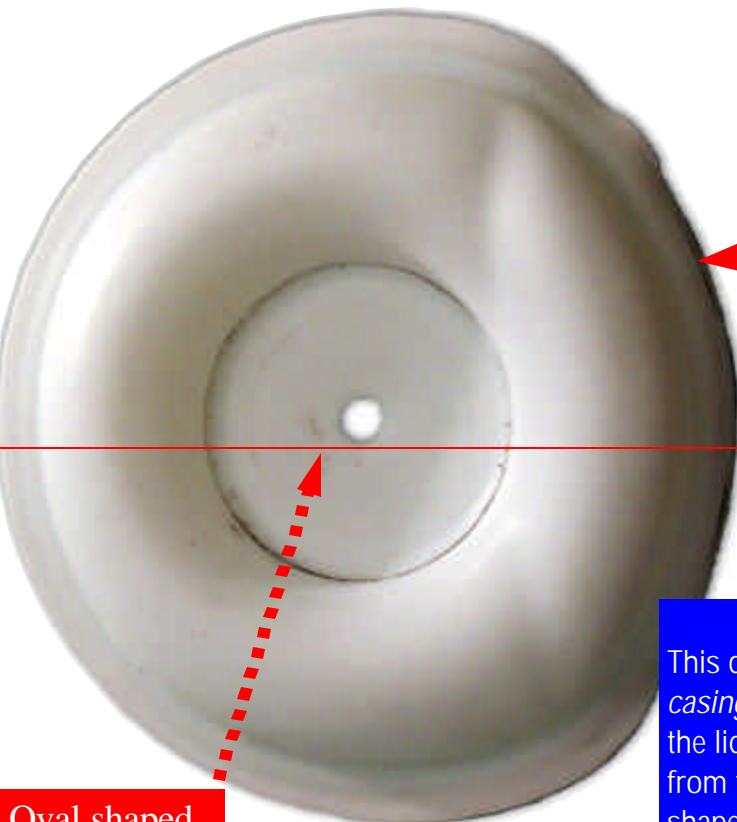
Cut on edge



This diaphragm will have a *pronounced cut around its outside edge*. This is caused by the chambers of the pump cutting into the diaphragms due to over tightening (usually metal only). This situation can be avoided by paying close attention to the torque values in the manuals.

## Under Torque

Edge pulled



Oval shaped

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This diaphragm's *outer edge will be pulled from the pump's casings* due to the fact that proper torque was not applied to the liquid chamber's bolts. The diaphragm, once removed from the pump, will appear to be "out of round" and oval in shape. One should see the outer lines on the airside of the diaphragm as uniform around and at one point they will travel off the diaphragm - indicating the area of pull.

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## Abrasion

Disk wear



On the liquid side of the diaphragm, one will notice an *abrasion ring worn where the diaphragm meets its outer disk*. Life of the diaphragms will dictate whether the abrasion is excessive; as some wear is normal. The pumps are rated to 40% by weight solids, however when this is exceeded or when solids are particularly sharp (ex. Silica Slurry) this type of failure is more common. Maintaining a good flushing system, paying attention to the % solids, using an abrasion pads and/or slowing down fluid velocities will help. Note: if a diaphragm is torn dramatically along the bottom side and one experiences bending of the center shafts this is definitely a solids settling issue and should be addressed accordingly.

## Over pressurization / Air side

Bloated



Diaphragm will have a *bloated appearance towards the liquid chambers*. The bloating is caused by uneven pressure on the diaphragm – in this failure mode the air pressure is greatly exceeding the required discharge pressure. A common cause of this is the opening up of a ball valve allowing the pump to run wide open before being fully primed. Remember that pressurizing the system in order to check for functionality or fully opening up the air pressure, before it is primed, are not recommended procedures.

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## Dry Running

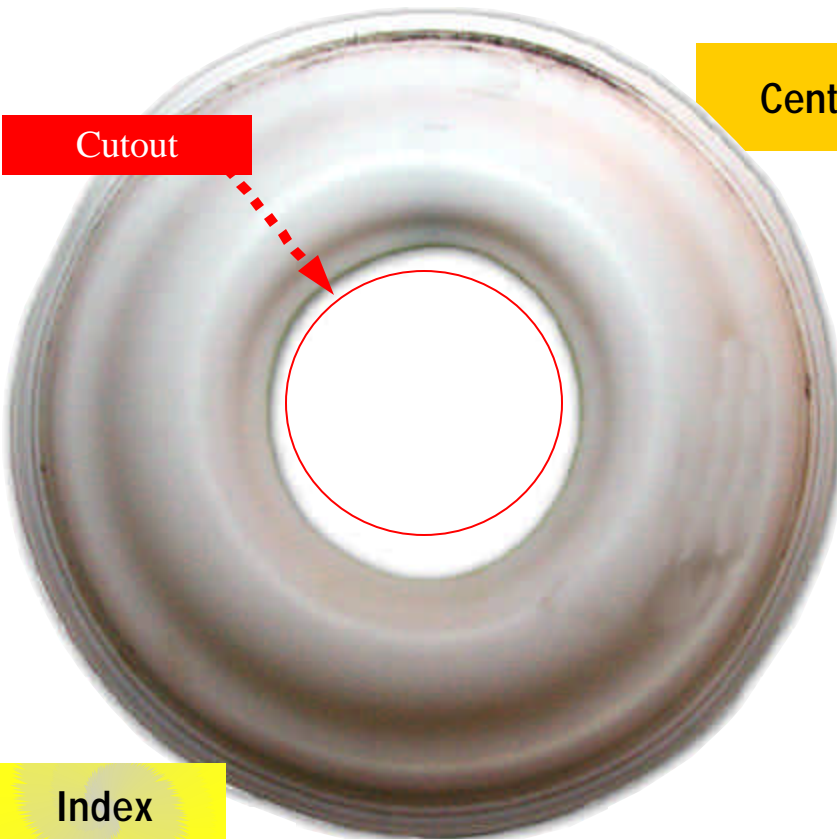
Star pattern



A diaphragm that has been dry run too much or too often will have a *star like wear pattern starting at the center extending outward* and *diaphragm life will be abnormally short*. Avoid this situation with proper operation via liquid level controllers, dry run protectors, speed control mufflers and/or by simply operating the system to avoid the dry running. The pump will not self-destruct when dry run, however the diaphragms have a cycle life whether there is liquid present or not. When the pump is run, with the presence of liquid or not, the diaphragm life is being consumed. This is compounded by a dry run situation - putting uneven pressure on the diaphragms and allowing for over speeding of the pump.

## Center Disk Cut / Backwards Installation

Cutout



Here you will see a *pronounced cut line around the center of the diaphragm* where the outer or inner disks came into contact with the diaphragms. When the center disks are installed it is important to make sure the round edges face the diaphragm to avoid a dramatic cutting effect. In addition, if the diaphragms are installed backwards, you will find this same dramatic cut around the center disks of the diaphragms. With either failure the life of the diaphragms will be dramatically short.

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