U Frame Solenoids Series 422 & 427

Description

This small solenoid has a very high force/size ratio. AC and DC types are externally identical but shading rings are fitted on the AC series 422 solenoid giving quiet operation.

Coils are varnish dipped and interchangeable. Coils are removed by springing open the U frame.

These solenoids are available in both pull and thrust versions.

Ambient Temperature

The information given on this page is based on a room temperature of 20°C allowing for a nominal 75°C temperature rise in the coil.

Maximum Permissible Voltage

Series 422 : 250 volts AC
Series 427 : 250 volts DC

Insulation

All coils proof tested to frame at 1500 volts RMS 50 Hz.

Closed Power (Continuous Rating)

Series 422 : 15 VA
Series 427 : 10 Watts

Weight

Total : 7·5 oz.
Plunger : 1·5 oz.

Approvals

Solenoids which are approved to the Canadian Standards Association requirements can be supplied if specified.

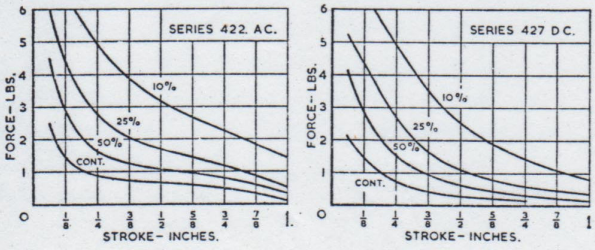
Maximum On Time

(See Page 72 "Rating")

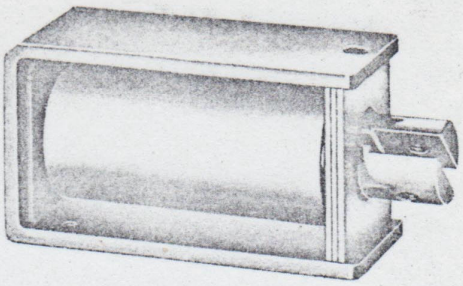
Series No.	10%		25%		50%	
	1 cycle	Cont. cycling	1 cycle	Cont. cycling	1 cycle	Cont. cycling
422	55 sec	40 sec	3 min	2 min	10 min	7 min
427	50 sec	30 sec	2 min	1·25 min	5·75 min	4 min

Force/Stroke Curves

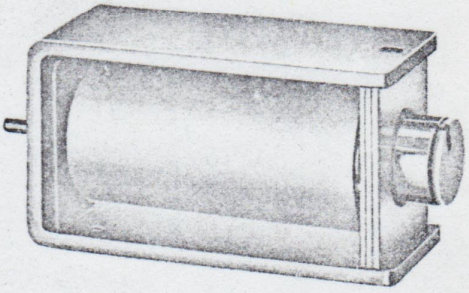
(See Pages 71, 72 and 73 "Rating" and "Force/Stroke Curves")



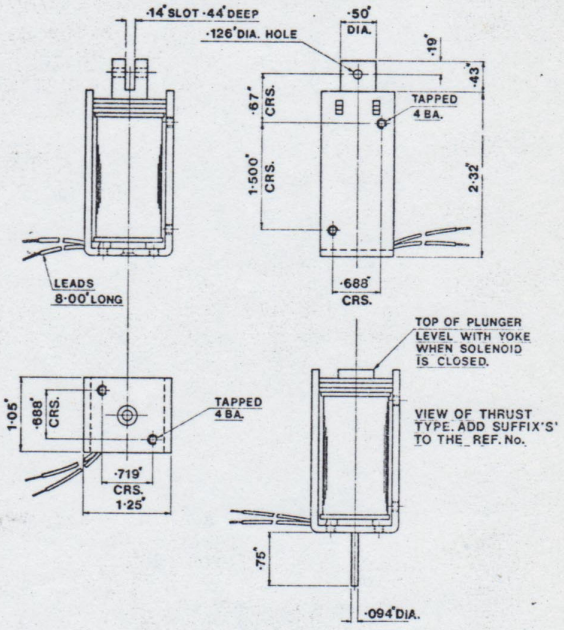
These force curves show average performance only. In addition to normal manufacturing tolerances, deviations can be expected at some voltages due to the coil winding sizes available.



Pull type



Thrust type



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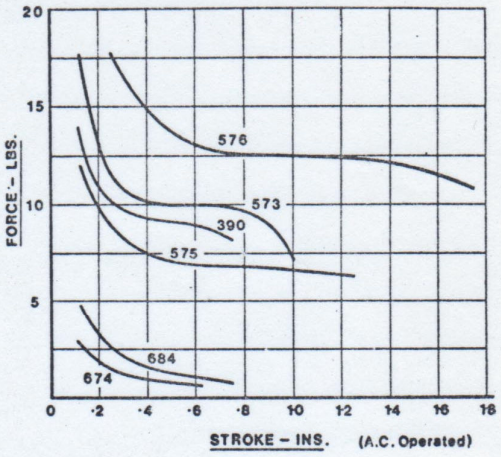
Force/Stroke Curve

When a solenoid is fully opened it has a large air gap. The reluctance of this air gap keeps the magnetic field small and the force correspondingly low. As the plunger closes the reluctance falls and the magnetic field increases. For this reason the force obtainable from a solenoid increases progressively as the plunger closes. Force/Stroke Curves are included for all of our solenoids so that you can match the solenoid to your duty.

These curves show the force exerted with the coil at full working temperature. The force exerted by a cold solenoid is always higher. Force variations with temperature are greatest on DC solenoids and least on laminated AC types, where inductance is involved. On DC solenoids the variations may be considerably reduced by condenser discharge operation. This effectively reduces the power in the hold position and consequently reduces the heating effect on the coil. Our Applications Engineering Department will be pleased to advise on suitable circuits for your applications.

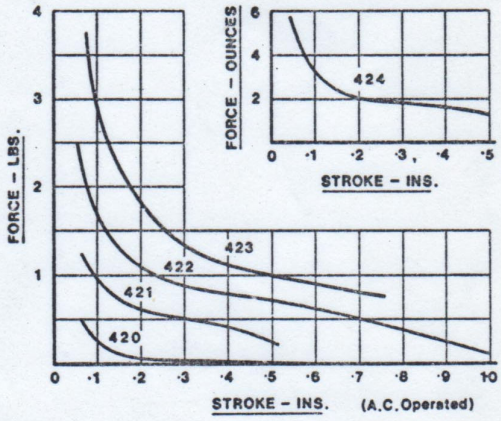


Matching Solenoid to Load

The Force/Stroke curves give the nominal force that will be available from the plunger at any particular plunger position. There will also be a matching duty cycle which will be the force required by the solenoids load throughout the stroke. In some cases this may be for practical purposes constant, as, for example, when a solenoid lifts a dead weight. In some cases, however, the mechanism may be spring loaded so that the force taken by the load is progressively greater as the plunger goes in. There may be cases when a solenoid is operating a number of linkages when the main loading is frictional. In this case the force required by the load may be greatest in the fully open position, in that once the static friction has been overcome the load resistance will fall.

The duty cycle of the load should always be matched as far as possible to the solenoid force curve. In many cases it may be found possible to use a smaller solenoid by altering the load cycle through levers or crank mechanisms.

Our Applications Engineering Department will be pleased to advise you of the best solenoid available to meet any particular application requirement.



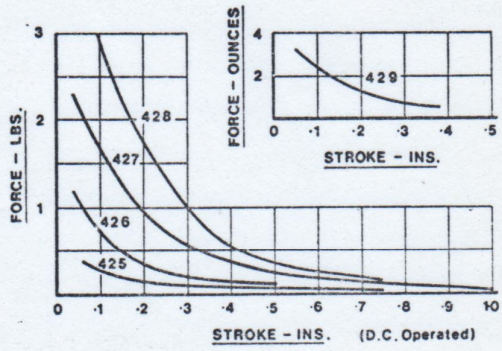
(CONTINUOUS DUTY CURVES SHOWN)

Operate Time

At any point in the operating stroke the difference between the force available from the solenoid and the force required to drive the load will be the force available to accelerate the load and plunger.

This means, of course, that the more excess power there is available from the solenoid the faster the solenoid will operate. The closing time of the solenoid is approximately doubled as its mechanical load is increased from 70% of what it will pull to the maximum: For reasonably fast operation, 25% excess power is advisable. As a general principle, the use of excessively large solenoids for the duty is not however good practice, as unabsorbed energy must be taken up as impact.

Condenser discharge circuits can be used to provide very fast closing while keeping the power in the hold position to a reasonable value.



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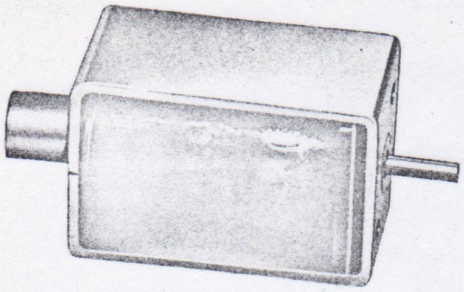
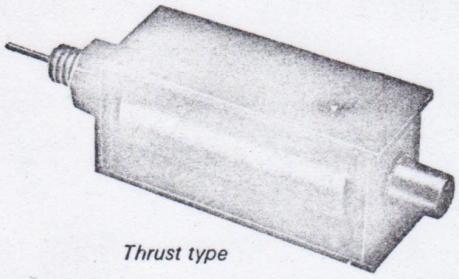
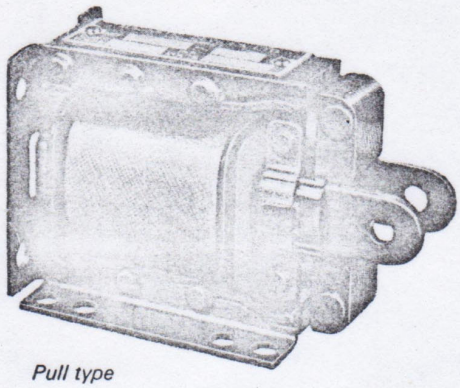


Thrust type

U Frame Solenoids

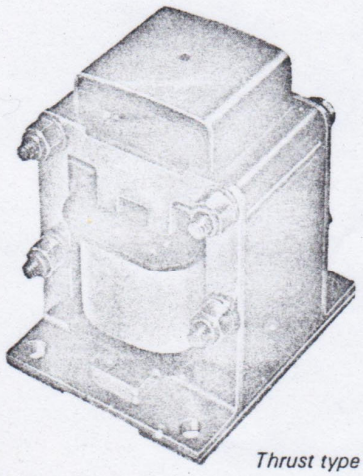


Thrust type



Pull type

Laminated Frame Solenoids



Thrust type

Rating

"Continuous Rating" means that the solenoid can be left on continuously without overheating. The force exerted and the power consumed are then the basic continuous rating values to which all other ratings are referred. In the case of an AC solenoid the continuous rating refers to the solenoid in the closed position only. If the solenoid plunger is withdrawn the "inrush" current will rise to a high value and if left energised will burn out. A continuously rated DC solenoid can be left energised continuously irrespective of the plunger position.

In many applications a solenoid is energised for only a short period and then left switched off for some time so that it can cool down. Under these circumstances the solenoid coil can be wound for a much higher power than the continuous rating value. As a result higher forces can be obtained with the proviso that the solenoid can no longer be continuously energised.

Suppose we have a time cycle of 25%, for instance, say 2 minutes on, 6 minutes off. This gives 2 minutes energised out of 8 minutes total which is a 25% rating. Under these circumstances we could increase the coil consumption four times. As the coil is only energised for a quarter of the time the average power consumption would remain the same. The same principle applies to all upratings. We publish performance curves for 25%, 50%, continuous, and in certain cases, 10% ratings.

On intermittent duty there is a limit to the total time energised which any uprated solenoid will stand in one "on period". The smaller the solenoid the shorter the uprated period it will stand continuously. For a large unit, 15 minutes on and 15 minutes off could be safe as a 50% rating. A miniature solenoid might well burn out after a few repeats of 2 minutes on and 2 minutes off. Our catalogue pages give the maximum "on time" for the various duty cycles.

In some cases solenoids may be required for intermittent operation but not on a fixed time cycle. To give some guidance on this we give for each solenoid the maximum "on time" for the different ratings on a single cycle basis. This is the maximum time this particular solenoid can be left energised when starting from ambient temperature of 20° C.

When **AC SOLENOIDS** are used on fast cycling, "inrush current" occurs at each closure. With fairly long cycle times where the solenoid closes and then remains energised for some time, the increase in power during the operate period has no significant effect. If the cycle time is fast, so that the solenoid barely has time to close before it is de-energised again, then the inrush current causes considerable extra heating effects. Fast cycling AC solenoids may require the use of continuously rated solenoids for intermittent duties.

Special coils can be provided giving very high forces for duty cycles below 10%, where a solenoid is only momentarily energised. Solenoid coils can also be wound for less than "continuous rating" force, taking appropriately less power. These reduced ratings may be advisable to prevent abnormal reduction of life where a solenoid operates a mechanical load well below its available power.

On any questions of rating our Applications Engineering Department will be pleased to advise you on your application. Where any doubt exists we will carry out heat run tests on your particular duty cycle.

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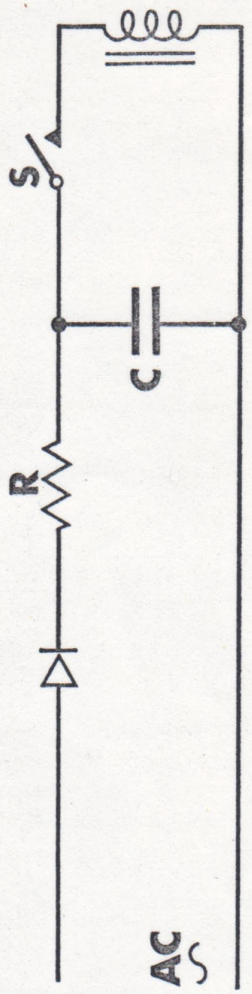
Condenser Discharge Operation

The high force of an instantaneous rating can often be provided by the use of a suitable capacitor/resistor circuit. This arrangement is particularly suitable for small solenoids, because larger sizes require an excessively large capacitor. Our Applications Engineering Department will be pleased to advise you of a suitable circuit for your own particular application.

Push-off Springs

On U frame AC solenoids, a ground plunger seating is used to prevent buzzing when energised in the closed position. With low force applications this seating can cause the solenoid to hold in on residual flux. To prevent this, standard push-off springs can be supplied.

Typical capacitor discharge circuit



Ordering Information

Having selected your solenoid you may wish to try this on a prototype basis. Our short order service will ensure that you get your prototype quickly. Please telephone our Sales Office for your prototype requirements.

If you cannot find a suitable solenoid in this catalogue for your application please send us details of your requirements. Often we can provide variations on standard solenoids which will suit a specific situation. If it would help you to discuss your application our Sales Engineers would be pleased to call on you. Please telephone or write to our Sales Office and we will arrange a visit.

When ordering, please quote :—

1. Series Number.
2. Operating Voltage.
3. Frequency (AC only)
4. Rating (continuous, 50%, 25%, 10%, etc.).
5. Pull or thrust type.
6. Push-off springs if required (see above).

The information contained in this catalogue is correct at the time of publishing but we disclaim responsibility for errors or omissions. We reserve the right, without notice, to alter designs or cease production of certain items as found to be necessary.

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