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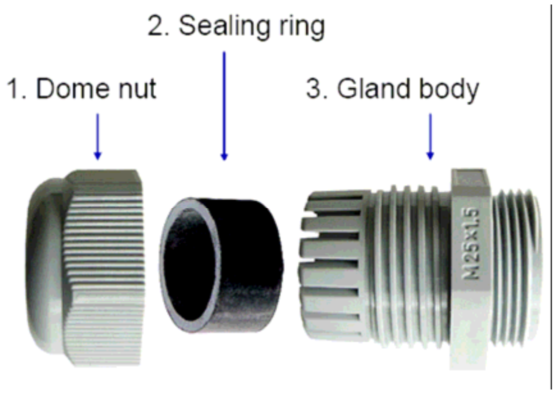
DIPTRONIC DIP100 / 110 LEAKAGE TEST & PRESSURE TEST

The recent cases of water ingress in the Diptronic heads has led to the leak testing of the DIP100 and DIP110 (low profile) assemblies. Testing of both units consisted of directional water testing using a hose, climate cycle testing, weather testing and lastly air pressure testing. Main areas of focus were the gasket sealing edges and the nylon glands. Each unit was assembled following the assembly procedure P7424. However, the pots were omitted for the purpose of this test, and a plate was used in place to replicate the seating position on the base of each Diptronic unit. Torque settings were closely adhered to in this test; this was to establish if our procedure contributed to water ingress.

To help trace water ingress, the units were dusted internally with powder. For the first test, each unit had water sprayed on all sealing edges and glands for five minutes. The units were then dried with an airgun and carefully disassembled. Water ingress was found in the DIP100 unit.

Figure 1

In figure 1, it can be seen that the way the pattern of the powder set around the cable, water ingress was through the gland. This was confirmed on closer inspection, as the gland dome nut was not tightened fully as with the DIP110 unit which was tightened all the way up. This was intentional, since the gland had no specified torque.



With the DIP110 unit, no leakage was found so it was reassembled. The DIP100 unit was cleaned and reassembled, this time with gland dome nut tightened all the way. The directional water test was then repeated another two times, with no further leaks found.

Next test was a climate cycle test which involves heating up each unit with a heat gun for five minutes and immersing the unit in cold water for another five minutes, then cooling each unit in the freezer for five minutes and immersing it into boiling water for five minutes. This test was conducted with an intention to find out if the units sucked in water with the expansion and contraction of the seals through heating and cooling. Each cycle was repeated another three times before it was disassembled and closely inspected. No signs of water ingress was evident, the glands were still tight and the gasket showed no signs of distortion. The lid also did not show signs of moisture or seepage around the sealing edges.

Next, was a weather test that placed each unit on top of the engineering container for the duration of two weeks. Each of the units did not show any water ingress or moisture setting in. This could be that the powder absorbed this and kept the internal surfaces dry. On closer inspection, there were no signs of water trapped within the unit. Condensation can build up over time, but there was not enough evidence to support this in the testing.

From these findings, a few areas need to be addressed in order to make sure the unit does not leak. Areas such as the torque settings of the glands and the bolts for the lid. From observations, if the gland-sealing ring is not seated correctly when the cable is installed it will allow water to enter, the chances of this is increased if the dome nut is not tightened correctly. Nevertheless, we can not completely rule out the moisture setting in on some units from this test, since in the field the variables can not be controlled. Such as some units with unpainted lids or installed incorrectly. This can explain where there are some cases of condensation build up or water entry. Another area is the porosity of the lids; a high porosity material has the tendency to absorb water. Thus, this can contribute to the water ingress.

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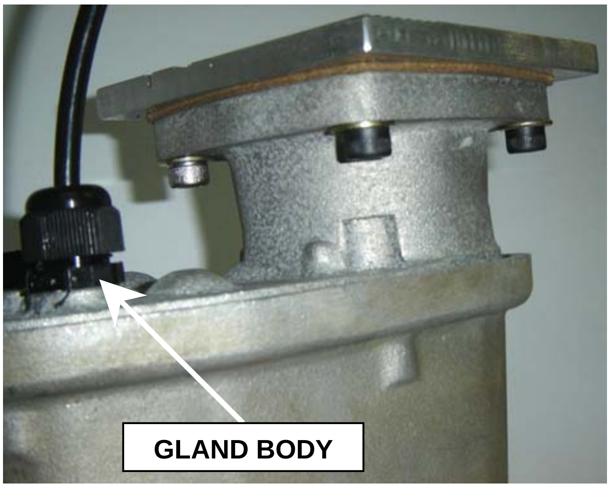
DIP100 Pressure Test

This test was performed after sourcing information regarding the glands torque specifications. It is a continuation of the previous tests conducted earlier in this report. The pressure test will aim to address the various factors relating water ingress.



The pressure testing consisted of sealing the base of the unit with a blanking plate and applying air through the gland. This tested both the gland sealing capacity and the porosity of the lid and base. In order to see an air leak, the unit was immersed in a tub filled with water. Evidence of leakage would then show up as bubbles. The gland was tightened to 3Nm; this setting was sourced from the manufacturer of the gland after the initial leak testing stated in the beginning of this report.

From here, air was fed into the sealed unit, as the air was being pumped through a leak occurred where the gland body meets the base. This occurred at 170kpa. Another test with a new gland returned the same result but at 110kpa. Note, at these extreme levels it exceeds the pressure levels that will ever occur in the field.

The next test left the unit immersed in the tub water for 5 minutes and setting the pressure to 275kpa. The aim of this test was to test the porosity of both lid and base. Since, it is considered a sealed unit, bubbles would have to form on the surface of the lid or base. Theoretically, a porous material has the tendency to absorb liquid, which also means that if a fluid can penetrate then a fluid can escape. This pressure test did not find any evidence that proved the theory of porosity had a factor in water ingress. To further this, the unit exploded ripping the screws from the threads at approximately 250kpa. This was not intentional, however it did emphasize the sealing capacity of the unit itself.

The pressure test has addressed many theories that have risen from the water ingress issues. Porosity of cast aluminium, the same material of the DIP100 units can be ruled out from these results, since the aim was to see if the lid or base was “breathing” in any way. Nevertheless, we can certainly see that the sealing capacity of the DIP100/110 unit is very high and that assembled with great care, the chances of water ingress is very little to none.

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EXECUTIVE SUMMARY

- DIP100 and DIP110 units leak and pressure tested.
- Testing addressed the issues of water ingress and porosity.
- Each unit was sprayed with a high pressure water hose for five minutes. Focusing on the sealing edges and cable gland. A leak was found in one of the units that did not have the gland dome nut tightened to the correct torque.
- Other unit had dome nut tightened all the way up, did not leak at all. Addressed the issue of having a torque specified. Torque setting to be 3Nm, specified by manufacturer.
- Both units reassembled and water testing repeated another two times. No leaks were found in both tests.
- Climate cycle testing was also conducted. This consisted of heating each unit for five minutes with a heat gun and immersing the unit in cold water for five minutes. Aim was to find if the unit would suck in water through expansion and contraction. Cycle was repeated another three times. No signs of water ingress found.
- A weather test was set up on top of the engineering container to expose the unit to the elements. Unit was taken down after two weeks and closely inspected internally. No signs of water ingress found.
- A pressure test conducted to address issues with porosity. A porous material has a tendency to absorb water. A sealing plate was fabricated and an air line fitting was connected to the base. Assembled to a raw, unpainted lid it was then immersed in a tub of water to show any leaks by the appearance of bubbles on the surface of the lid.
- No bubbles on the surface of the lid appeared.
- The sealing capacity of the unit was found to be very high, as it withstood a very high pressure before exploding.
- The chances of water ingress in these units have been concluded as being very little to none when properly assembled and installed.