

# **An interesting malfunction in a Bosch dishwasher**

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Issue 1  
February 27, 2026

## **FOREWORD**

Recently, a Bosch dishwasher installed in the author's home in 2012 refused to perform. When it was started, it went through some preliminaries and then came to a halt, its display giving a numbered error message.

After a tedious search of Internet references, the author concluded that the root cause of the problem was most likely misbehavior of the main washing pump in the machine. But the author's taking apart of washing machines was long in the rearview mirror. He called a respected local appliance service company.

They ran some diagnostic tests, but were unsure of the root of the problem (given certain aspects of the behavior). They were very taken by the author's theory of the cause, and it was decided (by a consensus of those present) that the pump in question should be replaced. It was replaced, and that solved the problem. An autopsy of the original pump, done by the author, confirmed that its bearings had in fact worn out.

This article tells that story in some detail.

## **1 THE DISHWASHER**

The dishwasher of interest is a Bosch "Ascenta" series machine, model series SHE6, purchased in 2012 for our newly-purchased home in Alamogordo,. New Mexico, and installed by me. It replaced an old "entry-level" dishwasher that was in place at the time. It is considered a fairly "upscale" machine for its time.

It had been run typically once per day since then. It had given little trouble over that time. A few years ago, a plastic door on the rinse agent filling port had broken, and that assembly was replaced (by me).

## **2 THE MALFUNCTION**

One recent evening, after dinner, my wife Carla went to run the dishwasher for the day's usage of plates, cups, glasses, silverware, and such,. She reported that it had not run its cycle. I saw that the display panel showed "E24", which I recognized as an error code.

I tried to start the machine again, and after hearing the sounds of some complicated preliminaries, the machine indeed halted and showed "E24".

A quick review of the user manual indicated that "E24" was indeed an error code, indicating malfunction in the draining process.

### 3 THE "DO IT YOURSELF" STORY

In the user manual, the "do it yourself" list of things to check, in the event of this error, included:

- Water recirculation filters clogged?
- Drain hose clogged?
- Drain entry to undersink drain system blocked?

These were all ruled out in this case.

## 4 THE PUMPS

### 4.1 Introduction

This style of dishwasher has two pumps, described below. Both are driven by synchronous 3-phase motors with permanent magnet rotors. These are driven by 3-phase AC signals generated electronically in the power control module in the machine.

It may be that the frequency involved varies with the function being performed, but the one motor nameplate suggests that the frequency is 150 Hz.

### 4.2 The sump

Both pumps draw water from a "well" (called the *sump*) which descends from the front of the floor of the *tank* (as the "chamber" of the dishwasher is called). The *recirculation filter system* (user cleanable) fits within this sump.

### 4.3 The drain pump

The *drain pump*, as one might guess from the name, drains the tank by pumping water from the sump through the drain hose into the undersink drain (or into a port provided for this purpose in the garbage disposal, if provided).

We do not have any details as to the drain pump's construction.

#### 4.4 The wash pump

This *wash pump* (and I use here one of its several names, as we will see shortly) draws water from the sump and pumps it into the two spray arms.

The pump unit also includes, in its discharge passageway, a cylindrical electrical water heater, the only heater in this type of machine. It is in two sections, of identical resistance (in the original pump). This is accompanied by two positive temperature coefficient (PTC) thermistors. These sense the temperature of the heated water and (through the *power control unit*) regulate the operation of the heater.

This pump is sometimes called the “recirculation pump”. Also because this unit includes a heater, is if very often called the “heat pump”, an unfortunate term given its quite different meaning as to home heating systems.

This motor has a 9-pole wound stator (the pole windings in three series groups, which are then wye-connected) and a 6-pole permanent magnet rotor. If indeed the applied 3-phase signal is at a frequency of 150 Hz, this would lead to a rotational speed of 50 rev/second, or 3000 RPM.

### 5 THE START UP SEQUENCE

#### 5.1 The plan

After considerable search on the Internet, I learned that this is supposedly the procedure this type of dishwasher goes through when one starts a normal wash cycle:

1. The drain pump runs (I think for an arbitrary time) to pump out any residual water in the tank (from the prior use).
2. To confirm the success of this, the wash pump is run for a few seconds and its current draw measured. If in fact all the water was removed by step 1, this pump “pumps air” and its current will be below some discrimination threshold. If so, the wash pump is stopped and the rest of the overall cycle is commenced (starting with the admission of water into the tank).
3. If the current is above this threshold, this is taken to mean that the wash pump is now pumping water, and thus indicates that the pumping out of all water in step 1 was not successful. In that event, the process proceeds as follows.
4. The drain pump runs again (again I suspect for an arbitrary time).
5. To confirm the success of this second try, the wash pump is again run for a few seconds and its current draw measured. If that

current is above the threshold, this is considered another failure of the drain pump to empty the tank. The cycle is halted, and error code "E24" is displayed.

## **5.2 The reality**

When we attempted to start a cycle,, we heard that process play out just as I have described it, the running of both pumps being clearly audible and the two distinguishable. After that the machine halted and showed error code "E24".

We noted that after the first running of the drain pump in this scenario, the sump was essentially dry. Thus in reality, there was no "failure to drain".

## **6 MAYBE**

This suggested to me another possible cause of the misbehavior: If there was some mechanical flaw in the wash pump (bearings worn, perhaps) there might be a drag such that when the wash pump is run to see if the drain pump had failed to empty the tank, the current drain would be high, leading to the (erroneous) decision that the drain process had failed.

Armed with that thought, I did another Internet search on "Bosch", "error E24" and "heat pump", and found a number of items that said, in effect, "Another common cause of failure to proceed, with error code E24, is misbehavior of the heat pump." (But this possibility was notably absent from almost all of the many discussions about what error E24 meant.)

## **7 THE "DOOR HACK"**

I found on the Internet discussion of an interesting "trick", spoken of as the "door hack". In a machine that halted during the startup operations, showing error code "E24", if, during those (presumably futile) preliminaries one opened the dishwasher door for a short while and then reclosed it (all operations of course ceased while the door was open), the machine would proceed into and through the washing cycle.

We found that is we used that trick, we could make the dishwasher actually wash a load of dishes.

## **8 PROFESSIONAL INSTALLATION**

There was a time that we would have ordered a replacement pump on-line and installed it ourselves, but I no longer have the stamina to do that kind of work, and there was of course the prospect that it would not go smoothly. So I called an appliance repair shop that had

done good work for us before. They sent a team of two technicians (I think a master-apprentice pair).

They went through the prescribed diagnostic tests, but were uncertain about the source of problem (especially since the actual drain process seemed to be occurring just fine).

I told them of my thought that this would all be consistent with the wash pump having, perhaps, worn bearings. All present agreed, and I committed to them replacing the wash pump. The part of course had to be ordered.

The part arrived almost two weeks later, and the same team came to make the installation. It was a bit complicated by the fact that, shortly after this machine was made, Bosch started using a different wash pump assembly in this model type, and the connector arrangements on it were different than on the old pump.

But the new pump came in a kit that included an alternate cable for one set of connections, and a partial harness that had to be spliced to an existing harness for another set of connections, and the techs dealt with all that nicely.

When the machine was put back on-line it seemed to behave properly. It has behaved properly ever since.

## **9 THE AUTOPSY**

I disassembled the old pump to see what the situation was. Both bearings for the rotor were badly worn, the holes in them substantially elongated, and the rotor shaft was badly worn in the two places where it ran in the bearings. There was no doubt but that this had allowed the rotor to rub the plastic cylinder inside which it ran (we could actually see "scuff marks" on the rotor and inside that cylinder).

## **10 THE STARTUP PROCESS NOW**

Now when we start a cycle, we first hear the drain pump run for what is probably the same length of time we heard before. Then the wash pump runs for just a short while, although the new one is so quiet that this is almost impossible to hear.

The rest of the cycle then proceeds without incident.

## **11 ABOUT THE DRAIN PUMP**

Although the drain pump is not seriously noisy, we suspect that if it were a new one it would also be almost inaudible in operation. So perhaps its bearings are by now a bit worn as well.

And we would not be surprised if, in a while, we got an error code that explicitly says that the drain pump is misbehaving. And so we will perhaps have it replaced at that time.

## **12 MORE ABOUT THE WASH PUMP**

The construction and operation of the wash pump motor are described in detail in the companion article, "A 3 phase pump motor in some Bosch dishwashers", by the same author, probably available where you got this.

## **13 ACKNOWLEDGEMENTS**

Many thanks to my stepson Larry, a treasured member of our household, and our chef de cuisine, among many other things, for his assistance in many ways as we dealt with this.

Thanks also to the two technicians who replaced the wash pump for their patience with a customer who thought he knew where the problem actually lay, and for their skilled work in replacing the pump. I won't mention their names or company here, as it is inappropriate to here "plug" any shop.

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