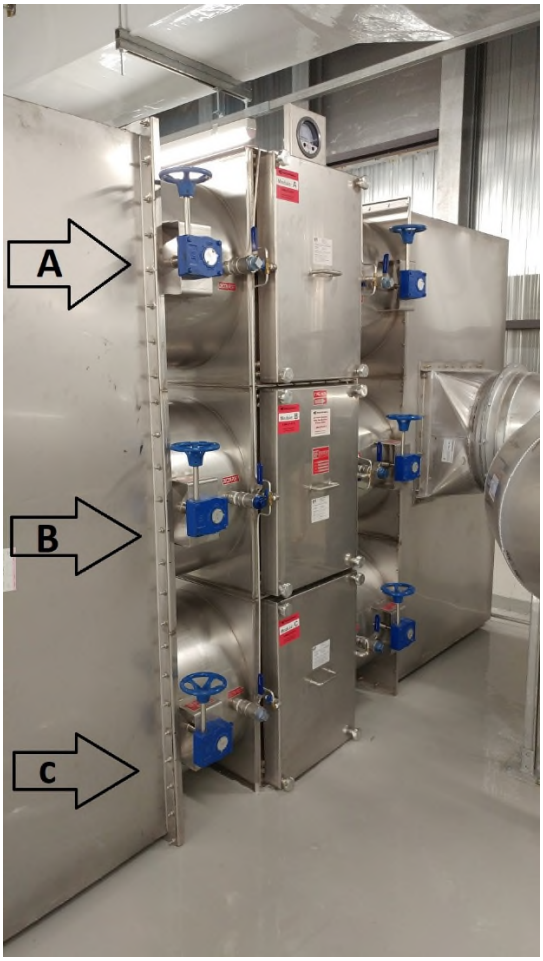
CTC BIBO Filter Systems
Operating & Maintenance Bulletin

Your Air Filtration and Dust Collection Specialists.

N+1 Redundant Filter System, SWITCHOVER PROCEDURE:

IAS Bulletin #198-11-16

IAS suggests using the sequence/checklist found on page3 to switchover an N+1 Redundant BIBO filter system. (An N+1 Redundant filter system has a minimum of three filter modules, with each module having its own filter section and inlet/outlet bubble-tight dampers. In other words, each module is an independent filter unit that can be completely isolated from every other module in the system. Think of each module as a completely separate unit, permitting each module to be isolated individually and tested individually. This switchover should be applied to the filter system and its fan (Primary & Standby fan) at the same time in order to equalize operational hours of each filter module and fan over the course of a year. IAS suggests switchover be completed on a monthly or bimonthly basis, using the same date (example, 15th day of the month) for each switchover.



Let's study the photo at left, an example of a three tier (three module) **N+1 Redundant** filter system. The filter system shown at left would have a model designation **B1-212-3x2**, with three filter rows high and two filters on each row. The entire filter system would have a total of six HEPA filters (3 high x 2 wide = 6 filters), along with six dampers (3 tiers x 2 dampers/tier = 6 dampers). As an N+1 redundant filter system, the capacity would be determined by calculating the capacity of four filters, since one tier/module would always be offline at any time. Of course, there are three permutations of operation for this filter system: A&B online, A&C online, and B&C online. Thus, for the switchover procedure, there are three distinct operating modes that should be equalized over the course of a year.

Two important things to note with this N+1 system, versus the fully-redundant filter system:

First, these N+1 redundant filter systems are always mated to a common inlet and outlet plenum, since that's the only feasible way to duct these systems, and

Second, the N+1 filter system has a single filter differential-pressure (DP) monitoring point, and thus requires a DP piping manifold. Its purpose and operation is explained in more detail on the following page.

Photo Above: Model B1-212-3x2, N+1 Redundant Arrangement

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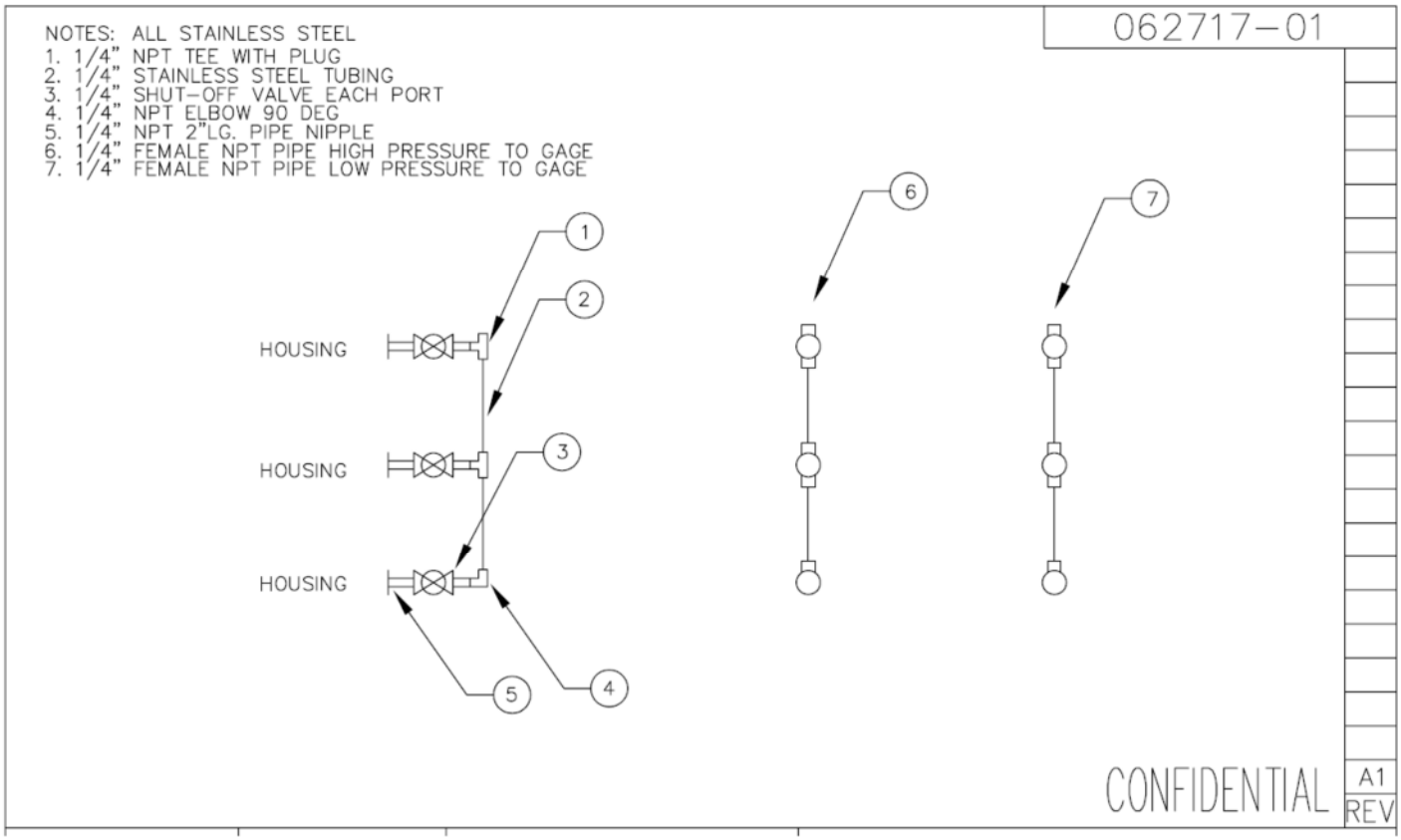
DIFFERENTIAL-PRESSURE GAGE MANIFOLD, suits model B1-212-3x2 Filter System:



The Differential-Pressure (DP) gage manifold depicted in the diagram above matches the manifold shown on the B1-212-3x2 system shown on page1. There are three tiers (or rows) on each of the positive-pressure (upstream pressure port) manifold and three tiers on the negative-pressure (downstream pressure port) manifold, for a total of six DP valves. (Just as there are six dampers on the three row/module N+1 filter system, there are a total of six DP ports required to measure filter DP. **It is extremely important to ensure that the gage-manifold valve is in the same position as the matching damper at all times.**

For instance, per our example shown on page1 of the three-module N+1 Redundant filter system, if Module A & module B are online (with module-C offline), then likewise, the filter DP gage-manifold ports on module A and module B must be online (and module C gage ports must be closed) in order to correctly measure the DP across the two filter modules that are online.

N+1 Redundant BIBO Filter Switchover Procedure (IAS Suggested Procedure/Checklist, ver 12-2016)	***Differential Pressure ("wc)***	***Motor Frequency (Hz)***
For the purposes of our example for this switchover matrix, we we use a three module BIBO, with Module A (top), Module B (center) and Module C (bottom). Of course, the N+1 Redundant BIBO can have up to eight modules, with four modules accessed from each side. (Each module should be clearly labeled to facilitate PM and record keeping.) Regardless of the total number of modules on the filter system, the intent of the N+1 Redundancy design is to have all-but-one modules operational at all times. The system must be able to maintain capacity and pressure-drop with "the largest single module off-line". (This allows for filter change-out on any single module without jeopardizing system capacity. (For further details refer to IAS Bulletin #101 or #102.)		
Once again, for the purposes of explaining the switchover procedure our example being a 3-module filter system, let's prepare a matrix for switchover from Modules A&B being online (with Module C offline), to Modules B&C being online and putting Module A offline....		
1. Confirm the online filter modules (A/B, A/C or B/C) by checking the damper actuator indicators on the inlet/outlet dampers and by recording the filter differential pressure. (Also record the motor Hz of the online fan.) For our example, the four dampers on modules A&B should be fully open, and the dampers on module C should be closed. Likewise, the gage manifold valves should be open at modules A&B, and closed at module C.		
2. A master log must be maintained where the sequence of online and offline modules is kept. For example: Month 1&2, Modules A&B are online; Month 3&4, Modules A&C are online, etc. This is the only way to ensure that the modules are sequenced regularly and that filter load is spread as equally as possible across all the modules.		
3. Open the inlet and outlet dampers on the standby module (Module-C), the module that is being put online during this switchover. Confirm that both damper actuators are OPEN.		
4. Likewise, open the filter differential-pressure port valves on the gage manifold at module-C, by turning the valves inline with the piping.		
5. Record the pressure drop with all three modules online; (the pressure-drop should be significantly lower with all three modules online.)		
6. Once you can confirm that the airstream is being handled through the system being brought online (module C), then you start to shut-off the dampers on module A, the module that is being taken offline during this switchover.		
7. After closing the two dampers on module A, then close the two gage-manifold valves at module A. Allow some time for the gage to adjust to the correct reading for the differential pressure of Modules B&C. Record the differential pressure.		
8. Check that the four dampers tied to modules B&C are open, and that the four gage manifold valves likewise are open at modules B&C. The switchover to the new module is now completed.		
9. Typically, the fan would be switched from primary to standby (or vice-versa) at this time. If so, then record the Hz once the fans are switched-over.		
FILTER SWITCHOVER, DATE & TECHNICIAN *(Date & Initial at right):*		

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