

	Production Equipment General Technical Cleanliness Requirements	HQ-G-C4-10
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1 Purpose and scope

This specification describes the requirements to be proven by the supplier.

Project specific details are fixed at the project specification and the process data sheet.

2 Application in NIDEC plants

This NIDEC Instruction applies to Business Division AMEC and the plants of NIDEC Motors & Actuators.

3 Level of confidentiality

This NIDEC standard specification is assessed as “internal”.

4 References / related documents

4.1 General

This chapter describes the additional requirements for design and usage of equipment for the “Technical Cleanliness” in the production. Basic requirements of general part of specifications are still valid.

- #1 Classification of technical cleanliness classes and particle size regarding the below.
- #2 All requirements that are described in this document are split into four different cleanliness classes.
- #3 A higher cleanliness class every time includes the requirements of the lower classes.

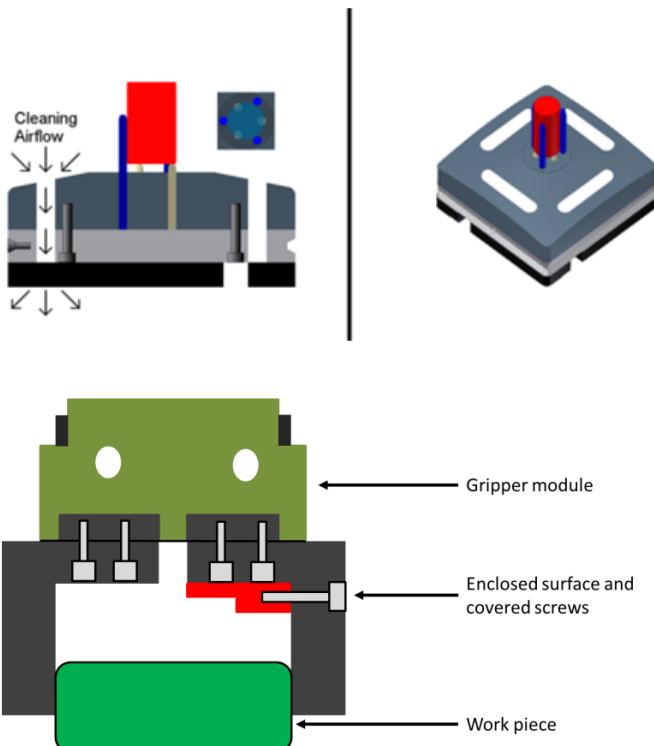
Cleanliness Class		
	Particle size in [µm]	
	non metallic	metallic
0	-	-
1	≤1500	≤1000
2	≤1000	≤ 600
3	≤ 600	≤ 400

- #4 The commissioned equipment must be so designed that the emergence and turbulence of particles is not possible.
- #5 The project manager monitors and investigates the implementation of the requirements listed in internal and external documents.

4.2 Design requirements

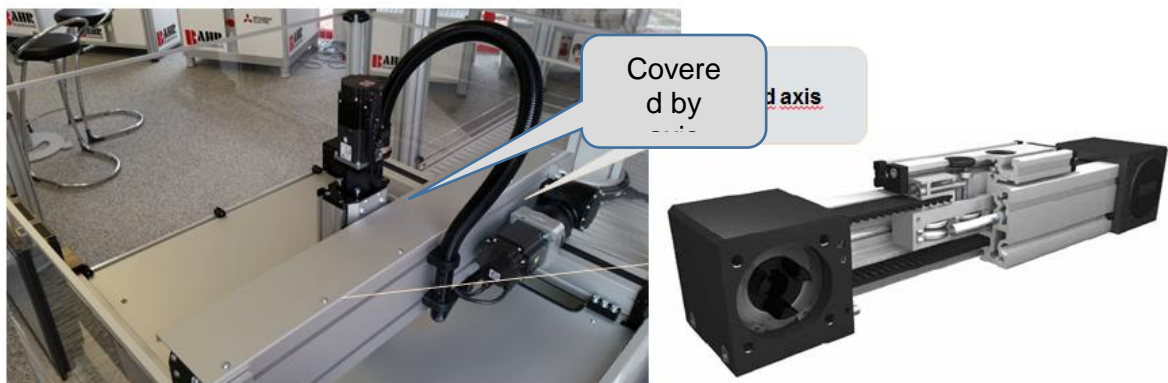
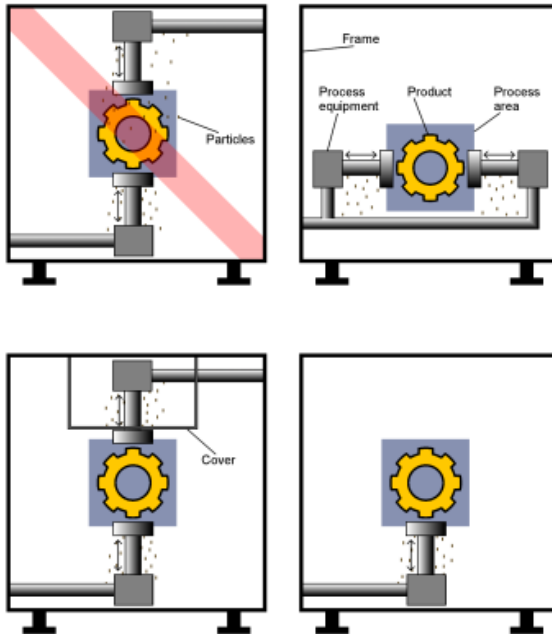
4.2.1 Cleanliness level 1

- #1 Surfaces are smooth and as enclosed as possible, so that particle deposition is difficult and cleaning is easy and efficient.
- #2 Work piece carriers, devices, grippers, etc. must be designed in a way that no possible particle nests exist. For example mounting from below, round edges, no gaps and corners.
- #3 Keep contact with the product surfaces low. Line contact is preferable to surface contact. If possible, use stainless steel.
- #4 Necessary coatings must ensure low abrasiveness.
- #5 Enclosed profiles must be used instead of open profiles with corners, gaps and edges.
- #6 Open profile grooves and end surfaces must always be provided with covers.
- #7 Undercuts, particle nests and narrow gaps have to be avoided in the design of the machine and transport frames.
- #8 Claddings and covers above the process area are closed to all sides. Maintenance and cleaning openings must be included. While opening, it is necessary that no dirt is able to enter the machine otherwise cleaning before the opening is necessary.

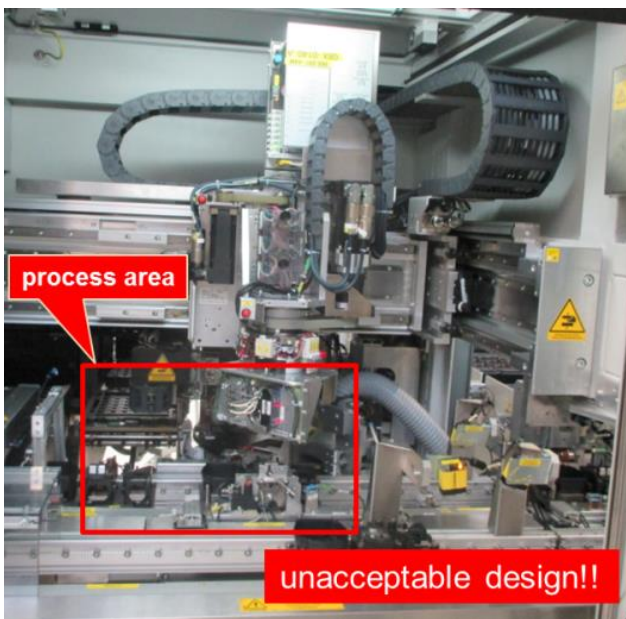


- #9 Fittings and hinges are mounted on the outside and under the process area. It is necessary to prevent particle nests.
- #10 Arrange handling guides to the side, or below the process area

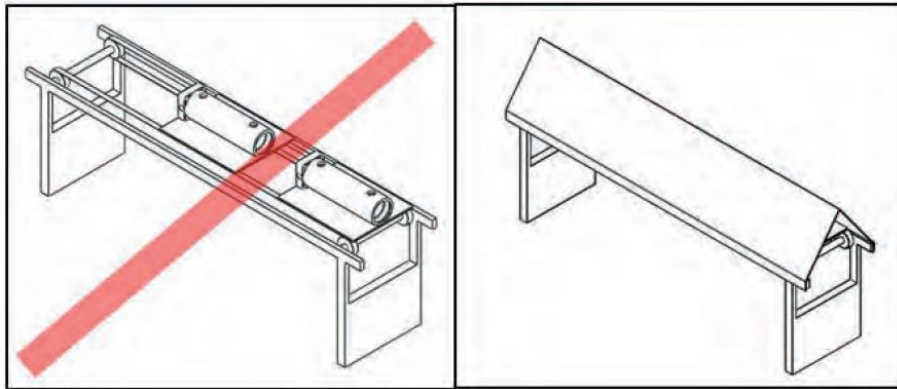
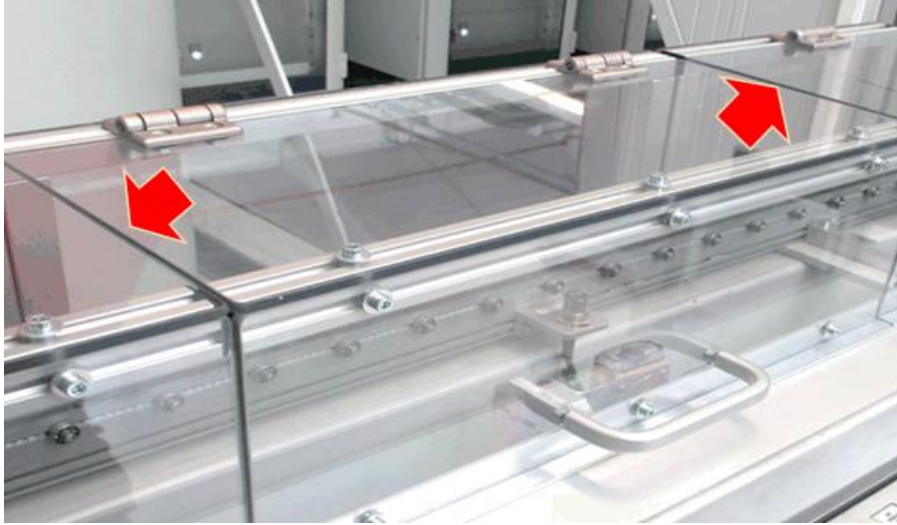
- #11 Guides that are positioned above the process area require a cover. The floor must be performed as a removable drip tray.



- #12 Drive and electric motors for guides must be passive cooled.
- #13 Motors and engines with active cooling must be approved from Nidec. It is important that the air flow is led to the outside of the process area.
- #14 Cables and hoses must be laid in ducts, hoses or pipes.
- #15 In the process area, the number of cable outlets must be kept as low as possible.
- #16 Cables and hoses must be below the process area.
- #17 Surfaces of hoses and ductus must be smooth to guarantee an efficient and easy cleaning.
- #18 Cables must not lay in closed profiles.
- #19 Energy chains above the product area must be closed to ensure an efficient cleaning and to prevent particles nests.



- #20 Work piece carriers need to be stopped centrally.
- #21 Work piece carrier stop positions are not allowed below the separation points.
- #22 Transport routes must be provided with a cover. The cover is to perform inclined to avoid “wild deposits”. Openings must be sealed.
- #23 Flaps, lids and doors of covers shall be such mounted that when they are opened or removed particles cannot enter the process area. If a particle contamination is visible, it is necessary to clean the surfaces before opening them.
- #24 Doors of covers must be placed on the side of the housing and not on top.
- #25 Hinges should be mounted at the lowest points of the covers.
- #26 Transport systems must be kept open at the bottom. Required safety covers need to be executed as a perforated plate.

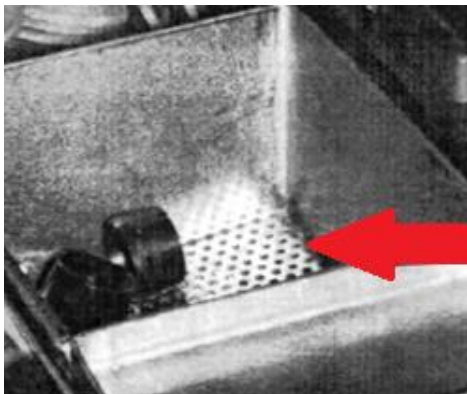


- #27 Material selection and machine tolerances must be designed in a way, that they do not cause any abrasion.
- #28 Air blowing mechanisms used in the process area and product environment, such as air flow cleaning systems and ionizers, must contain a filter unit with a filter size of $\leq 0.01 \mu m$ and an active coal filter (or a corresponding quantity connected in parallel, depending on the air demand). To monitor the filter condition, a pressure monitor is to integrate and PLC-monitored. A sustained drop in pressure > 1 bar generates an error message "Blown air filter check".
- #29 Exhaust of compressed air systems need to be collected and deposit over a filter bowl damper below the process area.
- #30 Exhaust air cleaning systems must be delivered via a filter with a pore size of $0.1 \mu m$ passed into the surrounding air.
- #31 Material feed rails have to provide a proper housing to ensure that no particles can enter while parts are stored.

- #32 Material feed rails have to provide collecting plates below them. The collecting plates must be removable without tools to ensure an efficient cleaning.

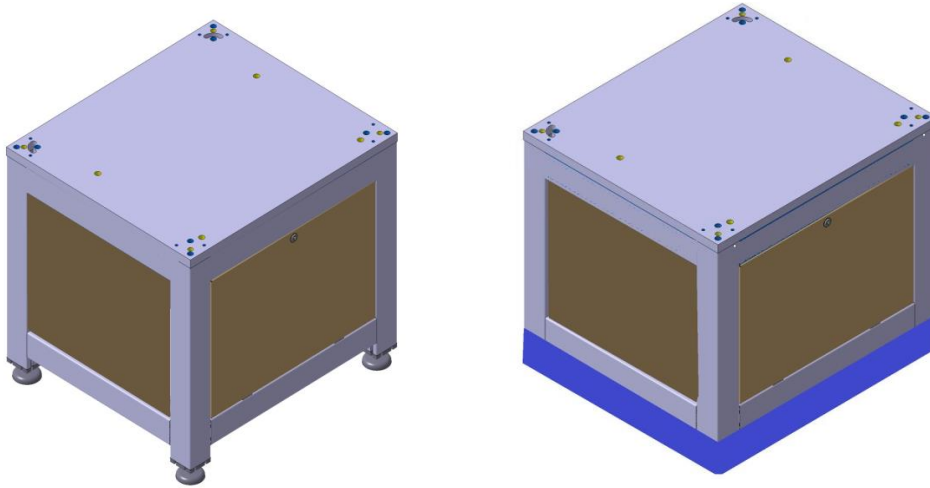


- #33 Gripping containers providing materials must be positioned laterally to the process area. Perforated plates on the bottom are used in the grip containers so that particles can fall away from the material.



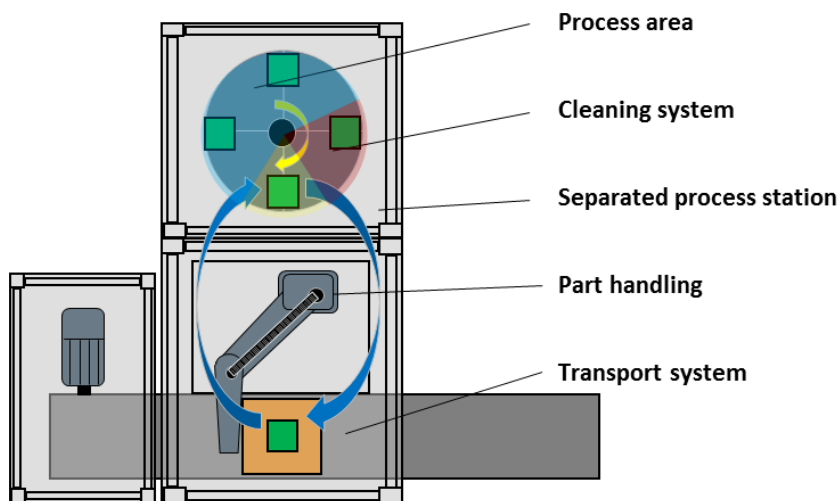
- #34 Adapters such as grippers, product specific devices, test adaption and work piece carriers must be protected in a suitable manner against contamination during storage. This is done with for example cabinets or hoods.
- #35 Condensation endangered pipes and hoses for cooling water e.g. need to be performed isolated to avoid condensate failure.
- #36 Partial containers need to be covered during a production interruption. Suitable elements need to be considered by the supplier and evaluated.

- #37 To provide particle nests, which are caused by cleaning, in the foot area under machine frames, cover plates should be installed.



4.2.2 Cleanliness level 2

- #1 If process with particle generation, example: metal welding, the process must be covered in a separate process station besides the general process flow.
- #2 If process is finished, before the parts will handle to the general process flow they must go through a cleaning system.
- #3 Decision must be made by the plant TC-expert.



4.2.3 Cleanliness level 3**4.3 Integration of cleaning systems****4.3.1 Cleanliness level 1**

- #1 **Manual cleaning with compressed air is absolutely forbidden in the process area and environment.**



Just cleaning with vacuum cleaner is allowed.

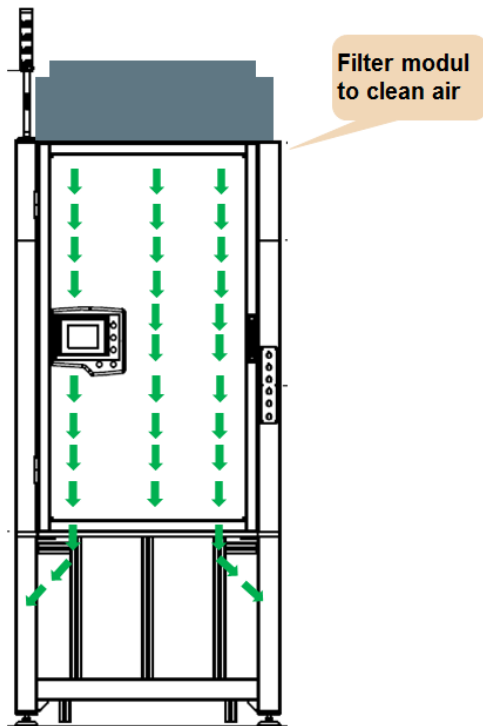
- #2 Systems with compressed air for cleaning have to have a suction system, which runs simultaneously.
- #3 Cleaning stations have to be performed in a way that no particles can enter other processes. This can be ensured with housings and laminar air flow.
- #4 Workstations need integrated lamps (cleaning lights) to make particle nests and particle contamination visible.

4.3.2 Cleanliness level 2**4.3.3 Cleanliness level 3****4.4 Usage of preferred components**

- #1 For the production of Nidec, preferred components and equipment according to the specifications and supplier lists should be used.

4.5 Machine area as local clean room**4.5.1 Cleanliness level 1****4.5.2 Cleanliness level 2****4.5.3 Cleanliness level 3**

- #1 The machinery frame has to be performed as a local clean room with the arrangement of a filter element above the safety frame.
- #2 The safety panel above the process area has to be performed in a way that the laminar flow is not affected.
- #3 The component has to be performed open under the process area so that particle can be washed away due to the laminar flow.



- #4 The filter element has to be performed in a way that during the time where the doors are open, the air flow ensures the cleaning effect, so that the particles cannot contaminate other processes or get spread.

4.6 Maintenance

4.6.1 Cleanliness level 1

- #1 Cleaning, maintenance and service cycle times need to be defined by the Nidec and the suppliers.
- #2 Process stations need to be easy and efficient to clean by the staff. The cleaning should be done by a special vacuum cleaner (toner suction) that is compact or fixed mounted. The filter system should ensure a particle size of $>0.12 \mu m$. The exchange of the filter and the dirt bag of the Hoover has to be done outside of the clean room area.
- #3 Permitted aids and cleaning materials must be clearly specified
- #4 Alternating cycles of wear components and filters must be listed in the maintenance plan
- #5 Maintenance of components that need to be disassembled must be done outside of the cleanliness area.
- #6 Maintenance and service tasks that have to potential of particle generation and spread must be done outside of the process area.
- #7 All parts that need to be change while maintenance or service must to be clean and without packaging once they enter the cleanliness area.
- #8 All cleaning materials, old parts and other objects that are necessary for cleaning, maintenance or service need to be disposed environmental responsible.

4.6.2 Cleanliness level 2

4.6.3 Cleanliness level 3

5 References / related documents

VDA-19-2

6 Specific remarks

None

7 Changes made since the previous edition

00 First edition

01 Clarification of related NIDEC plants