

... IN THE ACCEPTANCE OF MACHINES AND PRODUCTION EQUIPMENT




The following question always arises when you purchase, retrofit or maintain machines and production equipment: "Is the performance of the machine or equipment established according to respective specifications?"

In the past, the geometrical specifications of equipment have been evaluated e.g. as described in ISO 282. Nowadays, real parts are normally produced first, then the relevant characteristics are measured and finally the measurement results are evaluated by means of statistical analyses. These results decided whether you accept the machine and equipment or not.

You can distinguish between machines producing different parts and production equipment manufacturing parts specifically for a limited product range (e.g. engine blocks, camshafts, etc.). Equipment purchasers define the specifications of the parts to be produced and define the most important characteristics of the part (one-sided or two-sided specification limits). The characteristics, if necessary, are allocated to different classes such as critical, significant, important or similar. Each class is assigned to a limit the capability index is not allowed to exceed. Machines and equipment are only accepted when each characteristic meets the required capability index. If a characteristic does not reach the defined limit, you have to take corrective action. The process owner can also decide whether the machine is accepted even though it deviates from defined specifications.










The manufacturer of the machine or equipment is usually responsible for initial acceptance. The process is repeated again when the equipment is installed at the customer's. However, both cases apply different limits the capability indices have to meet.

In case of a universal machine, you first have to define the parts and associated characteristics the machine is supposed to produce. Otherwise, you proceed as described above.










Error 1		There is no clear definition and specification of acceptance conditions.
Effect		The acceptance of machines and production equipment often leads to needless discussions about how to proceed. The major subjects of the debate are the limits the capability indices of the respective characteristic have to meet.
Solution		Associations like VDMA, VDA or conglomerates provide acceptance guidelines including many years of experience. The reference book "Statistical Procedures for Machine and Process Qualification" includes Bosch, Daimler, GM and VW guidelines. You should either transfer the contents of those guidelines "one-to-one" to your application or define an individual approach based on these guidelines.






The seven most frequent errors in the acceptance of machines and production equipment




Error 2		The acceptance at the manufacturer's is not prepared properly. Raw material might be missing, the machine does not run properly or you do not make a cold or warm start.
Effect		Customer waste too much time which causes travel costs for an unnecessary or new journey and waiting time.
Solution		Create a checklist containing all the tasks that shall be done before machine acceptance. The manufacturer has to complete and sign the check list and sends it to the customer. Only then the customer visits the supplier for acceptance. If the manufacturer does not perform the required tasks properly, he will bear the risk of possible acceptance costs.
Error 3		Before acceptance, you only do the machine adjustment off the top of your head.
Effect		Too many attempts are required needlessly wasting raw materials and time.
Solution		The one-part report helps to adjust the machine properly. When the machine passes the five-part report subsequently, it is most likely that the whole test can be completed successfully. The one-part report and five-part report as well as associated limits become part of the acceptance guidelines. qs-STAT is able to generate these reports and shows or prints them any time.
Error 4		The measuring instruments do not have any interface to the Q-DAS product qs STAT or do not provide data in the Q-DAS ASCII transfer format.
Effect		In case of complex parts including many characteristics, it becomes complicated to transfer measured values. This leads to errors and requires a lot of time.
Solution		The interface to measuring instruments is defined in the "AQDEF" guideline. Q-DAS offers the certification of interfaces. The certification ensures a correct transfer of data. These data will then be available in qs-STAT for statistical analysis and a real-time evaluation of results. You may quickly take appropriate corrective action.

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Error 5		You did not conduct any capability analyses for the applied measurement systems.
Effect		The results might be regarded as incorrect leading to permanent discussions about the causes of these deviations or violated limits and whether they result from the machine or the measurement process.
Solution		Performance studies have to be based on MSA or GUM / VDA 5. The Q-DAS product solara.MP supports you in performing them. Find more information in the reference manual "Measurement Process Qualification" or in corporate guidelines.
Error 6		The method calculating the capability index is often not specified properly.
Effect		This leads to frequent discussions about calculated capability indices.
Solution		ISO 22514-2:2015 provides the basis for the calculation of capability indices. Most of the corporate guidelines listed above have adopted them. qs-STAT includes the calculation methods and the procedure leading to validated calculations.
Error 7		Many non-validated Excel form sheets with macros for the calculation of results include errors.
Effect		Depending on the configuration, the calculated results are wrong or inaccurate which makes them useless.
Solution		Apply a validated evaluation strategy in qs-STAT.

FURTHER ERRORS

Error 8		Multidimensional characteristics like positional tolerances are treated like one-dimensional characteristics.
Effect		The capability indices are wrong.
Solution		In order to define P_o and P_{ok} , use the method qs-STAT includes (or see ISO 22514-2:2015).

Error 9		The technical documentation is incomplete; especially environmental conditions are missing.
Effect		The causes of deviations and errors are no longer retraceable in case of subsequent complaints.
Solution		Use the check list to define all environmental conditions required.

Use the Q-DAS software qs-STAT to avoid many of the errors listed above.