



Rolls-Royce

SABRe: A Guide to Visual Inspection

Supplier Briefing Pack

©2006 Rolls-Royce plc

The information in this document is the property of Rolls-Royce plc and may not be copied or communicated to a third party, or used for any purpose other than that for which it is supplied without the express written consent of Rolls-Royce plc.

This information is given in good faith based upon the latest information available to Rolls-Royce plc, no warranty or representation is given concerning such information, which must not be taken as establishing any contractual or other commitment binding upon Rolls-Royce plc or any of its subsidiary or associated companies.

A Guide to Visual Inspection

Purpose:

- **To provide a structured approach to non-dimensional inspection**
- **To reduce quality escapes i.e. component deliveries which contain visual non-conformance**

Should it be necessary for Rolls-Royce to carry out inspection on components delivered by the supply chain?

- **Inspecting received components:**
 - adds no value to the components
 - adds to Rolls-Royce overhead costs, which affects competitiveness, hence ability to win new business for the benefit of the supply chain
- **Rolls-Royce contracts with its supply chain to provide conforming products therefore should be able to rely on the integrity of suppliers' final inspection**
- **Ask yourself what your reaction would be if you were required to inspect any personal goods that you purchase (e.g. a new car or stereo system)?**
 - Would you have the capability to perform such a task?
 - Who is the best person to perform such a task?
 - Who has the necessary equipment and processes to perform the task?

SABRe: Guide to Visual Inspection



Rolls-Royce

A Guide to Visual Inspection

Historical experience shows:

- **70% of components rejected by Rolls-Royce contain visual discrepancies:**
 - **A high proportion of these are what we refer to as “SOFT ISSUES”**
 - **Part or serial number missing**
 - **Incorrect part number**
 - **Inadequate packaging resulting in damage**
 - **Incomplete paperwork and labelling**

A Guide to Visual Inspection

Errors occur during manufacture !

- In SPC terminology these are referred to as “SPECIAL CAUSES”
- It is the responsibility of Inspection to detect these errors and seek acceptance or rejection via the appropriate rework or non-conformance process
- A considerable amount of effort is put into obtaining gauges and fixtures, but our eyes are the best tools at our disposal.
- The problem is that we often start using gauges and miss the obvious.

A Guide to Visual Inspection

The consequences of not detecting errors:

- **Parts do not fit causing expensive delays**
 - **An engine costing several million \$s cannot be delivered if it is awaiting a part costing a few \$s because a non-conforming batch has been returned to the supplier**

- **Parts fit but contain non-conformance, which does not meet the design requirements**
 - **This can lead to reduced life or a malfunction of the part in service and as a worst case scenario may hazard the safety of operation**

- **These circumstances lead to:**
 - **Customer dissatisfaction**
 - **Potential loss of sales to Rolls-Royce**
 - **Loss of business to the supply chain**
 - **Potential loss of jobs**

EXERCISE 1

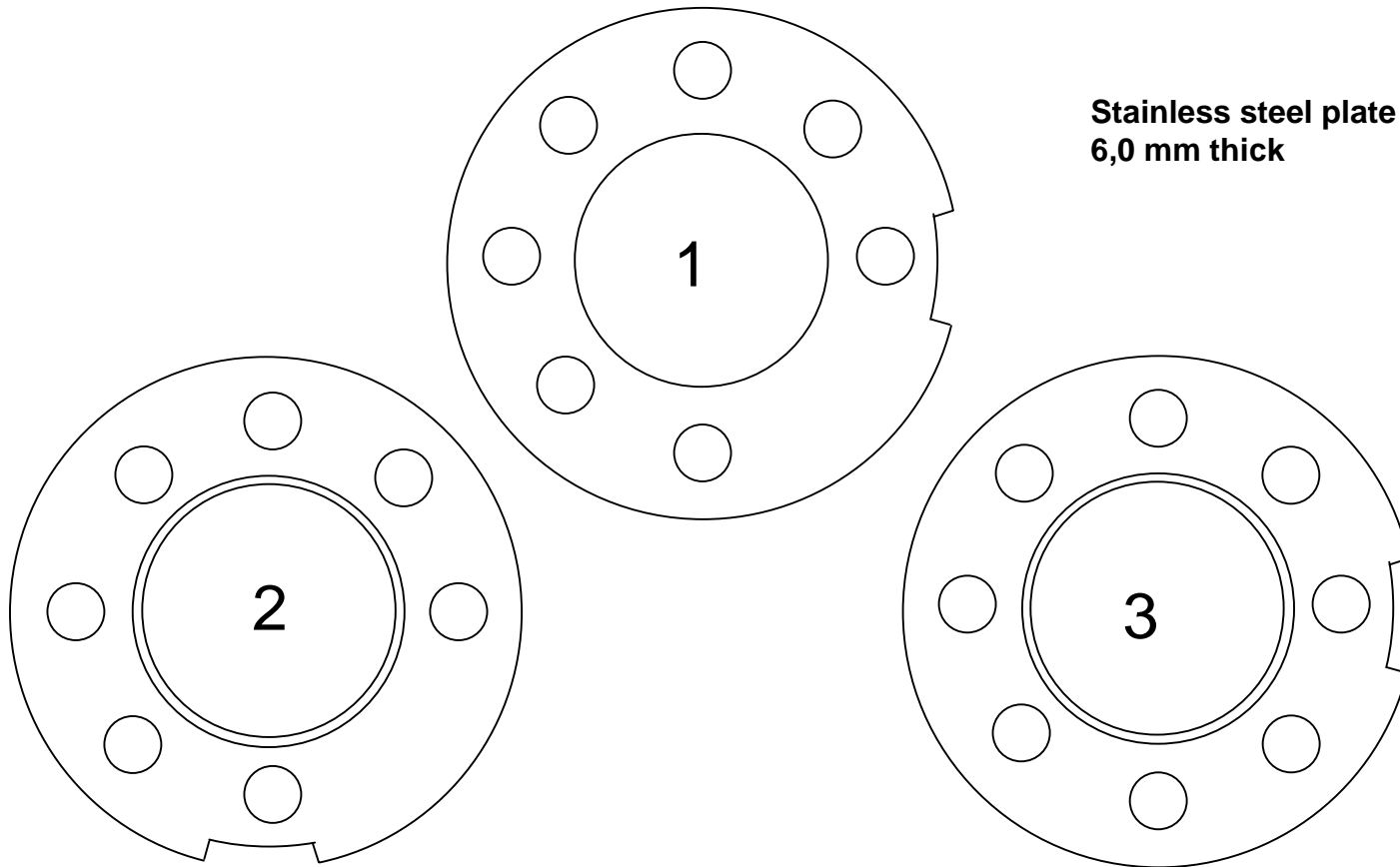
SABRe: Guide to Visual Inspection



Rolls-Royce

A batch of 3 components has been delivered.

What conclusions can be drawn?



SABRe: Guide to Visual Inspection



Rolls-Royce

- **Component 2 appears to be the same as 1, rotated through 90 degrees but containing a chamfer around the centre diameter.**
 - **If 2 is flipped over and has no chamfer on the other side, would it be the same as 1?**
- **3 appears to be the same as 2 , but has an additional hole.**
 - **If this additional hole is a blind hole and 3 is flipped over, would it be the same as 1 or 2?**
- **There are other possible scenarios that could apply. See how many you can come up with.**

A Guide to Visual Inspection

What Have we learned?

- **We have not used a single piece of measuring equipment and yet we have discovered a lot using our eyes**
- **We can deduce a number of possible scenarios.**
 - **One of these scenarios could be correct, or all could be wrong**
 - **All parts could be correct because they are a mixed batch of parts - their individual part numbers may not be marked and / or paperwork could be missing**
- **Until we know what the requirements are for this batch of parts, there was no point in starting the assessment**

Understanding the requirements

There are 3 sources of requirements:

- **The component definition**
 - Drawings (inc. Repair Schemes for R & O)
 - Technical Specifications - RPS, EDS, JES, MSRR, RQS, etc.

- **Contractual requirements**
 - Rolls-Royce Purchase Order(s)
 - SABRe
 - Notice to Suppliers (NTS)
 - see www.suppliermanager-online.com
 - International Standards - ISO 9000 Srs., AS 9100, AS 9102 etc.

- **Agreed variances**
 - Concessions / Waivers / DDR's - as applicable
 - Production Permits
 - Drawing Alteration Requests
 - Approval Plans
 - Quality Plans

SABRe: Guide to Visual Inspection



Rolls-Royce

Familiarisation with the drawing and specifications

Things to consider:

- What are the important features?
- What are the restrictions and constraints?
- What are the common features and how many are there?
- Are there any offset features (e.g. holes)
 - What is their orientation?
- What are the tolerances?
 - This gives an indication about what method of machining could be used (e.g. turned or ground - does the surface finish reflect this?) and what inspection equipment is required
- What are the geometric controls?
- What feature is the maker likely to have checked / not checked or missed?

- **READ THE NOTES AS WELL AS THE DIMENSIONS!**

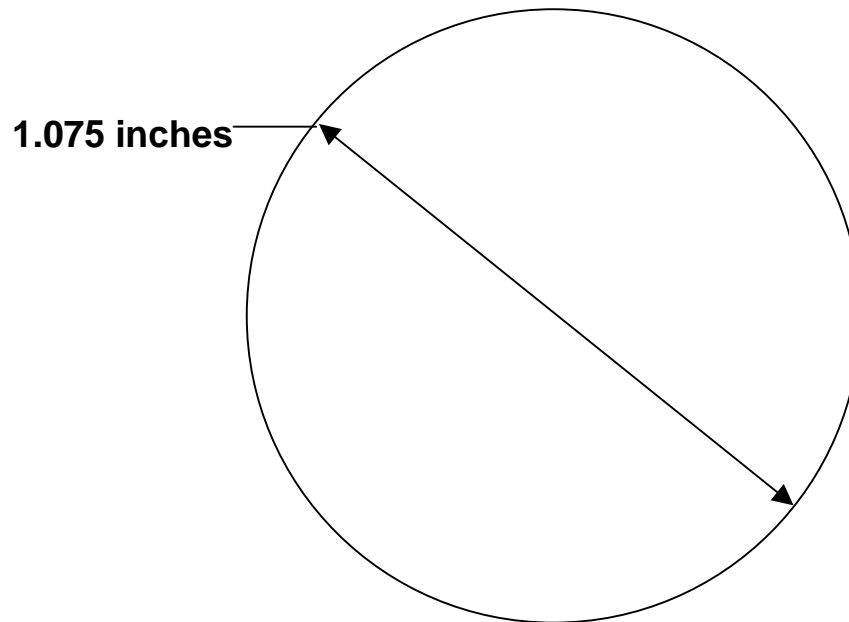
EXERCISE 2

SABRe: Guide to Visual Inspection



Rolls-Royce

What equipment would you use to check this?



NiAg alloy
0.090 in
thick

- **Since no tolerances are quoted a general tolerance applies**
- **Most people would therefore suggest a Vernier Calliper or 1-2 inch Micrometer to check this definition**

Does this meet the design requirements?



The picture shows a British coin - the 50 pence piece, which along with the smaller 20 pence piece is unique in design, because wherever measured across the centre the result will always be the same, which could make one conclude that the coin is round, but our eyes tell us otherwise.

This lobed effect is common (although less evident) on thin semi-flexible components, often caused by badly designed clamping during machining and sometimes goes undetected.

If you look back at the drawing, the 1.075 dimension is not designated as a diameter, yet pictorially the drawing is indicating that the item is circular - in other words the design intent is not clear and should be queried.

SABRe: Guide to Visual Inspection



Rolls-Royce

Familiarisation with the contract

Points to consider:

- **Are there any special requirements referenced on the Purchase Order?**
- **Most Rolls-Royce orders invoke SABRe requirements within the standard terms and conditions**
- **SABRe mandates a number of processes - First article Inspection, Packaging etc. (refer to www.suppliermanager-online.com)**
- **This website also provides access to Notice to Supplier (NTS) documents that may be applicable**
- **Flow down of contract requirements to the sub-supply chain is mandatory. Any purchased goods and services must comply with the Rolls-Royce contractual requirements (e.g. use of approved suppliers).**
- **Classified Parts Controls requires that the supply chain seeks authorisation for any change to methods and sources of supply**
- **Traceability requirements require suppliers to submit and maintain documented history of parts and processes**

THE USE OF A GOOD CONTRACT REVIEW PROCESS CANNOT BE UNDERSTATED

BUT

THE RESULTS MUST BE EFFECTIVELY COMMUNICATED TO THOSE PERSONS RESPONSIBLE FOR :

- **CONFIRMING CONFORMANCE TO THE DEFINITION AND PURCHASE ORDER**
- **RELEASING THE PARTS**

EXERCISE 3

We identified that we can gain significant information about conformance to requirements using our eyes alone.

Spend a few minutes writing a list of things that can be detected without the use of measuring equipment

EXERCISE 3

- **Accompanying this briefing pack is a complimentary document entitled “Visual Inspection - Basic Requirements”.**
- **This lists a lot more than the 20 or so things that most people think of when doing this exercise.**
- **The guide is not an exhaustive list and there will be other factors that can be added which may be specific to your business. Therefore add to and adapt the guide to suit your own needs.**

Improving visual assessment skills

- **It is useful to line parts up in the same orientation**
 - **The principle of a television is that you do not see the electrons, that cause the screen to fluoresce, travelling across the screen because your brain retains an image for about 1/25th of a second.**
 - **By quickly alternating between parts in the same orientation, differences can be detected.**
- **Look for the unexpected but do not overlook the obvious**
- **Identify what requires further investigation or measurement.**
- **Ensure that any differences or discrepancies are reported and followed up.**

Remember your other senses

Hearing:

- **Shake parts and listen for any rattles**
 - There may be certain features that do rattle e.g. sliding nut plates, which indicate that they are fitted and not too tight
 - if a rattle is heard, when none should be evident, swarf may be trapped
- **Metallic parts should have a characteristic ring when lightly struck.**
 - Age hardened nickel based parts that have a dull thud when struck have been acid cleaned and have suffered unacceptable inter-granular corrosion (micro-cracks)

Touch:

- **Fingertips are extremely sensitive to changes in surface profile but please ensure that parts are free from burrs**

Smell:

- **Manufacturing processes and materials have characteristic smells that they impart to components**
 - Parts which have been pressure tested with oil should have a characteristic smell. A lack of smell may indicate that the pressure test has been omitted

Remember those SOFT ISSUES mentioned at the start?

It can all go wrong in the despatch department!

- **Is all documentation complete?**

Batch Card:

- **All operations completed, in correct sequence and accounted for**
- **All endorsements and concessions resolved**

First Article Inspection Report:

- **Complete and signed**
- **All supporting documentation available and correct and on the latest issue of form (refer to SABRe - “Use of Forms” for additional detail)**
- **All SABRe requirements satisfied**

SABRe: Guide to Visual Inspection



Rolls-Royce

Release Note:

- **Complete including any endorsements**
- **Signed / Stamped - as applicable**
- **Approved supply sources quoted**
- **Traceability maintained between delivery and manufacturing documentation**
- **Fully compliant with SABRe Release Note (CoC's) Process**

Packaging:

- **Part number, serial numbers and quantities correct**
- **Parts undamaged cleaned and where applicable protected.**
- **Dunnage cannot get into parts**
- **Packaging to SABRe Protection, Packaging and Labelling Process
- unless otherwise instructed**
- **Non-conforming parts identified, separately packed and released.
Concession(s) approved**

SABRe: Guide to Visual Inspection



Rolls-Royce

Closing thoughts

“Aviation itself is not inherently dangerous, but to an even greater degree than the sea it is terribly unforgiving of any carelessness, incapacity or neglect” (Anon)

We work in an industry whose products demand the highest skill levels, workmanship and integrity in their execution.

Our contribution must match this and so help to ensure the degree of safety, reliability and assurance that the flying public expects.