

PAINT COATINGS ORANGE PEEL AND DEPTH OF IMAGE MEASUREMENT

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Restrictions described in the norme

*This is a translation, the French original shall be used in all cases of litigation**Date of translation : 25/03/2002*

USE RESTRICTION

This méthode d'essai replaces, for **NEW DESIGNS**, the following méthodes d'essai :

- **D25 5105 PAINT COATINGS – SURFACE TENSION**
- **D25 5378 PAINT COATINGS – SURFACE TENSION AND DEPTH OF IMAGE (AUTOMATIC MEASUREMENT)**

1. OBJECT AND FIELD OF APPLICATION

The object of this méthode is to describe a method of operation for the measurement of the orange peel effect and image clarity of a paint film. It applies to flat or convex surfaces where the radius of curvature is greater than 200 millimetres.

The test must be carried out on a clean and dry surface free from graining, scratches or dirt (dust, fingerprints..).

2. PRINCIPLE

The test consists of projecting 2 light beams perpendicular to the paint film and recording the image reflected using a camera. This image is transmitted analogically to the central processing unit via a cable, then digitalised, analysed and processed by suitable calculation algorithms.

3. DEFINITIONS

Orange peel effect

Defect representative of large surface ripples in a painted surface due to the macro-geometrical distortion. This defect is without unit measurement.

Image clarity

" Blurred " reflected image due to the micro-geometrical distortion in a painted surface. This defect is without unit measurement.

High plate

Painted plate with an orange peel effect and image clarity greater than 60.

Low plate

Painted plate with an orange peel effect less than 50 and image clarity less than 60.

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4. EQUIPMENT

4.1. QMS BP+ EQUIPMENT (Quality measurement system portable battery)

This equipment measures the orange peel effect and image clarity of a paint film. It is supplied by the PERCEPTRON Company, 47827 HALYARD DRIVE, PLYMOUTH MI 48170 (USA), according to Appendix 1.

4.1.1. A CENTRAL PROCESSING UNIT,

portable equipped with a 486 processor or equivalent, a 3.5-inch disk drive, with a numerical keypad and a data display screen. It may be powered via the mains or batteries (4.2.2.).

4.1.2. A MEASURING HEAD,

with a data display screen containing 2 rows of light emitting diodes (LED), 2 image reflecting mirrors with an angle of 45° and an analogue camera, according to Appendix 2.

4.1.3. A CABLE,

connecting the central processing unit (4.1.1.) to the measuring head (4.1.2.).

4.2. ADDITIONAL EQUIPMENT

4.2.1. A BATTERY CHARGER AND POWER CABLE,

suitable for charging 3 batteries one at a time or simultaneously.

4.2.2. BATTERIES,

three 12-volt 1.5-ampere nickel cadmium batteries.

4.2.3. ONE MAINS POWER SUPPLY (110 V – 220 V) AND POWER CABLE

4.2.4. ONE STORAGE CASE FOR ALL THE EQUIPMENT

4.2.5. A CARRYING CASE FOR THE CENTRAL PROCESSING UNIT

4.2.6. A GAUGE FOR DAILY CONTROL PLATES AND MONTHLY CHECKING PLATES

4.3. DAILY CONTROL PLATES

Set of 2 plates: one high and one low, painted in an opaque colour provided by DPTA/DMOV/MXP/PEI.

- The plates must be free from scratches, dirt, prints, etc.
- They may be lightly cleaned with a soft dry cloth (4.5.) or with a soft cloth (4.5.) soaked with water then wiped dry with a soft cloth (4.5.).
- The use of any products (alcohol, detergent...) is prohibited.

Plate requirements : Repeatability of the average of 10 orange peel and image clarity measurements: ± 3 (6.2.2.).

4.4. MONTHLY CHECKING PLATES

Set of 2 plates: one high and one low, supplied with the equipment provided by company PERCEPTRON:

- The plates must be free from scratches, dirt, prints, etc.
- They may be lightly cleaned with a soft dry cloth (4.5.) or with a soft cloth (4.5.) soaked with water then wiped dry with a soft cloth (4.5.).
- The use of any products (alcohol, detergent...) is prohibited.

Plate requirements : Repeatability of the average of 10 orange peel and image clarity measurements: ± 3 .

4.5. CLOTHS

Soft and lint-free, for example from the supplier ESSUINET EIF rue de Pierre, 93104 MONTREUIL CEDEX.
PSA Reference P935 851 982.

5. PREPARATION OF THE TEST SPECIMENS

The dimensions of the surface to be examined must be greater than 80 mm x 130 mm, be flat or convex with a radius of curvature greater than 200 mm.

In the case of test specimens or vehicles that have been subjected to a change in the surface condition after paint curing (example: dust deposit, etc), wipe with a soft cloth (4.5.) or clean the surface with a soft cloth soaked in water and wipe with a soft dry cloth (4.5.).

6. METHOD OF OPERATION

The QMS BP+ equipment shall be previously configured by the department concerned to be able to comply with the procedure described below.

The screens described in this § are displayed on the measuring head and the central processing unit.

Concerning the measurement on a convex part, the measuring head shall be placed perpendicularly to the radius of curvature, according to Appendix 3.

6.1. STARTUP

Connect the central processing unit (4.1.1.) to the measuring head (4.1.2) via the cable (4.1.3.). Connect the mains power supply (4.2.3.) to the central processing unit (4.1.1.) and to the mains, the current frequency must be between 50 hertz and 60 hertz.

Turn on the equipment by pressing the ON/OFF button on the central processing unit.

The main menu appears:

MAIN MENU - 1: Topcoat 2 : Primer 3: E-Coat 4: Data 5: Computer Mode – – CHOICE ?
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Note: The E button on the numerical keypad of the central processing unit can be used to return to the MAIN MENU at any time.

Before measuring, it is essential to let the equipment warm up for at least **30 minutes**, to obtain thermal stability for the analogue camera.

6.2. CONTROL AND VERIFICATION OF THE EQUIPMENT

6.2.1. SELECTION OF THE CONTROL OR VERIFICATION PROGRAMME ON PLATES (4.3. or 4.4.)

Select the menu FINIT by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

```
Begin new measurement series
Enter style [ 1 . . 32] ( E = Escape ) >
```

Select STYLE 1 corresponding to the equipment TEST program (10 measuring points) by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

```
STYLE : TEST
Enter color [ 1 . . 32 ] (E = Escape ) >
```

Select the VERIF colour corresponding to the checking programme colour by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

```
TRIG : Confirm TEST VERIF
REP : To Re-enter Style and Color
```

Press **the green pushbutton** on the measuring head (TRIGGER button), to validate the choice.

The following screen appears:

```
TEST VERIF
Measure ( TRIG = Pos 1 )
```

To make the first measurement, press **the green pushbutton** on the measuring head.

The following screen appears:

```
01 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9
Measure ( TRIG = Pos 2 ) ( REP = Pos 1 )
```

To make following measurements, press **the green pushbutton** on the measuring head.

Repeat the operation until the end of the TEST programme (10 measurements).

At the end of the programme, the following screen appears:

```
10 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9
Save data for charts ? TRIG = Yes, SKIP = No
```

Press the **green pushbutton** on the measuring head (TRIGGER button), to validate the end of the programme and save the data.

The following screen appears:

Enter style [1 . . 32] (E = Escape) > or REP : TEST VERIF
--

At the end of the first series of 10 measurements on the high daily control plate (4.3.) or monthly checking plate (4.4.), press the REPETE button on the measuring head then repeat the various measuring steps for the high plate.

After measuring the low plate, press **key E** on the numerical keypad of the central processing unit to return to the MAIN MENU.

Save the date to disk (6.5.) and erase the data off the hard disk (6.6).

6.2.2. MEASUREMENTS ON DAILY CONTROL PLATES

These measurements on daily control plates must be taken before using the equipment, after observing the equipment warm up period.

1. Position the measuring head with the measuring window facing upwards.
2. Position the gauge with the fixing screw opposite to the measuring head handle.
3. Tighten the fixing screw on the gauge without forcing it to avoid damaging the measuring head.
4. Slide the low plate into the grooves of the gauge with the painted face facing downwards.
5. Position one of the two sides of the plate at mark 15 on the gauge. The plate must cover the measuring window.
6. Make the first measurement by following the instructions of § 6.2.1.
7. Measure 4 other points by sliding the plate 5 mm between each measurement following the instructions of the § 6.2.1.
8. Remove the plate from the slots of the gauge and turn it round with the painted face still facing downwards.
9. Carry out steps 4 to 8 in order to measure the 5 additional points.

Repeat steps 4 to 9 for the high plate.

The average of image clarity and orange peel measurements must be within the tolerance of the daily control PLATES : ± 3 points compared with the nominal values for orange peel and image clarity indicated on the back of each plate.

Otherwise, it is necessary to verify the monthly checking plates (4.4.).

6.2.3. MEASUREMENTS ON MONTHLY CHECKING PLATES

This § is applicable in the case of measurements on daily control plates that are not included within the tolerance interval or in the case of monthly control of the equipment after the observance of the warm-up period for the equipment.

- Repeat the steps described in the previous § (6.2.2.), for the high and low reference plates.

The average of image clarity and orange peel measurements must be within the tolerance of the reference plates : ± 3 points compared with the nominal values indicated on the back of each plate.

Two cases may arise:

- The averages of the two parameters are within the tolerance.
→ The daily control plates must be replaced.
- The averages of the two parameters are not within the tolerance.
→ The equipment and the monthly checking plates must be checked by the Supplier.

6.3. GRADING OF THE DAILY CONTROL PLATES

The grading of the daily control plates must be carried out each time new plates are received in order to determine the nominal values of orange peel and image clarity.

6.3.1. SELECTION OF THE PLATE GRADING PROGRAMME

Select the menu FINIT by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

Begin new measurement series
Enter style [1 . . 32] (E = Escape) >

Select STYLE 4 corresponding to the TEST programme of the equipment (10 measuring points) by pressing **key 4** on the numerical keypad of the central processing unit.

The following screen appears:

STYLE: 4
Enter color [1 . . 32] (E = Escape) >

Select the VERIF colour corresponding to the colour of the checking programme by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

TRIG : Confirm 32 measurements to check
REP : To Re-enter Style and Color

Press **the green pushbutton** on the measuring head (TRIGGER button), to validate the choice.

The following screen appears:

32 measurements to check
Measure (TRIG = Pos 1)

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To make the first measurement, press **the green pushbutton** on the measuring head.

The following screen appears:

01 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9 Measure (TRIG = Pos 2) (REP = Pos 1)
--

To make the next measurements, press **the green pushbutton** on the measuring head.

Repeat the operation until the end of the 32 measurements.

At the end of the program, the following screen appears:

10 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9 Save data for charts?

Press **the green pushbutton** on the measuring head (TRIGGER Button), to validate the end of the programme and to save the data.

The following screen appears:

Enter style [1 . . 32] (E = Escape) > or REP : 32 measurements to check
--

At the end of the first series of 32 measurements on the high daily control plate or monthly checking plate, press the REPETE button on the measuring head then repeat the various measuring steps for the high plate.

After measuring the low plate, press **key E** on the numerical keypad of the central processing unit in order to return to the MAIN MENU.

Save the data to disk (6.5.) and erase the data off the hard disk (6.6).

6.3.2. GRADING MEASUREMENTS ON DAILY CONTROL PLATES

1. Position the measuring head with the measuring window facing upwards.
2. Position the gauge with the fixing screw opposite to the measuring head handle.
3. Tighten the fixing screw on the gauge without forcing it to avoid damaging the measuring head.
4. Slide the low plate into the grooves of the gauge with the painted face facing downwards.
5. Position one of the two sides of the plate at mark 15 on the gauge. The plate must cover the measuring window.
6. Make the first measurement by following the indications of § 6.3.1.
7. Measure 7 other points by sliding the plate 2 mm between each measurement following the indications of the § 6.3.1.
8. Remove the plate from the slots of the gauge and turn it round with the painted face still facing downwards.
9. Carry out steps 4 to 8 in order to measure the 16 additional points.

Repeat steps 4 to 9 for the high plate.

Indicate on the back of each plate the nominal value (average of the 32 measuring points) for orange peel and image clarity.

6.4. MEASUREMENTS ON VEHICLES

Connect a battery then disconnect the mains. If a slot on the battery charger (4.2.1.) is vacant, put the previous battery on charge.

Select the FINIT menu by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

Begin new measurement series
Enter style [1 . . 32] (E = Escape) >

Select STYLE 2 to 32 (except 4) by pressing the keys on the numerical keypad of the central processing unit.

Depending on the configuration, the number of measuring points from each TYPE may vary. By default, type 2 corresponds to 26 measuring points (for saloon cars) and type 3 to 22 measuring points (for the people carriers, convertibles or large commercial vehicles).

The following screen appears:

STYLE: 5
Enter color [1 . . 32] (E = Escape) >

Example: the operator will have selected STYLE 5.

Select COLOR 2 to 32 by pressing the keys on the numerical keypad of the central processing unit.

The following screen appears:

TRIG : Confirm STYLE 5 COLOR 13
REP : To re-enter Style and Color

Example: the operator will have selected COLOR 13.

Press the TRIGGER button on the measuring head to validate the choice

The REPETE button on the measuring head allows the choice to be modified.

The following screen appears:

STYLE 5 COLOR 13
Measure (TRIG = Pos 01)

Position the equipment on the surface to be measured then press the TRIGGER button on the measuring head.

Note: When measuring a curved part of the vehicle, the radius of curvature must be greater than 200 mm and the measuring head must be positioned at a perpendicular to the radius of curvature, according to Appendix 3.

The following screen appears:

01 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9
Measure (TRIG = Pos 2) (REP = Pos 1)

Pressing the REPETE button on the measuring head allows the measurement to be taken again.

Pressing the PASSE button will skip the next measurement and go straight to the third measuring point (the values will then be 0 by default).

During the measurement, the green diode on the measuring head lights up when the measurement is correct.

The orange diode lights up when a measurement is made incorrectly (window placed incorrectly against the measured surface, surface not reflective, ...). The following screen appears:

Measurement fails
Measure (TRIG = Pos 2) (REP = Pos 1)

Press the TRIGGER button again to repeat the measurement.

Note: *It is not necessary to press on the REPETE button.*

Position the equipment on the next measuring point, then press the TRIGGER button on the measuring head.

The following screen appears:

02 : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9
Measure (TRIG = Pos 3) (REP = Pos 2)

Repeat the operation n time until the end of the measuring program.

The screen corresponding to the last measurement is as follows:

X... : GL : 99.9 DO : 99.9 OP : 99.9 CO : 99.9
Save data for charts? TRIG = Yes, SKIP = No

Press the green pushbutton on the measuring head (TRIGGER button) to validate the end of the program and to save the data on hard disk

The following screen appears:

Enter style [1 . . 32] (E = Escape) > or
REP : TEST 5 CHECKING 13

Press the REPETE button on the measuring head to repeat the same programme (same type, same colour) or press the ESCAPE button on the numerical keypad of the central processing unit to return to the MAIN MENU. Save the data to disk (6.5.) and erase the data off the hard disk (6.6).

6.5. SAVE AND EXPORT DATA

MAIN MENU - 1 : Topcoat 2 : Primer 3 : E-Coat
4 : Data 5 : Computer Mode -- CHOICE ?

Select the DATA menu by pressing **key 4** on the numerical keypad of the central processing unit.

The following screen appears:

DATA - 1 : Clear 2 : Print 3 : Report 4 : Save
5 : Charts 6 : Export 7 : Import 8 : Main Menu

Select the SAVE menu by pressing **key 4** on the numerical keypad of the central processing unit.

The following screen appears:

SAVE DATA – Put a disk in the drive
ENT : Continue E : Escape

Insert a formatted disk in the drive of the central processing unit.

Note: *The disk must be formatted beforehand.*

Validate by pressing the ENT key on the numerical keypad of the central processing unit.

The following screen appears for a few seconds:

**Copying data file to backup file
A : 00010101.DAT**

The filename is allocated automatically

The first two figures correspond to the year, the next two figures to the month, the next two figures to the day and the last two figures to the file No. recorded in the day.

The program automatically returns to the MAIN MENU.

6.6. DELETE DATA FROM THE HARD DISK

**MAIN MENU - 1 : Topcoat 2 : Primer 3 : E-Coat
4 : Data 5 : Computer mode -- CHOICE ?**

Select the DATA menu by pressing **key 4** on the numerical keypad of the central processing unit.

The following screen appears:

**DATA - 1 : Clear 2 : Print 3 : Report 4 : Save
5 : Charts 6 : Export 7 : Import 8 : Main Menu**

Select the CLEAR menu by pressing **key 1** on the numerical keypad of the central processing unit.

The following screen appears:

**CLEAR DATA - Are you sure ?
ENT : Continue E : Escape**

Validate by pressing the ENT key on the numerical keypad of the central processing unit.

The program automatically returns to the MAIN MENU.

7. EXPRESSION OF THE RESULTS

The orange peel effect and the image clarity of the measured sample are expressed by the figures given by the equipment.

The orange peel and image clarity values are located between 0 and 99.9.

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8. PRECISION

8.1. ORANGE PEEL

- The repeatability is $\pm 1,9$.
- The display accuracy is 0,1.

8.2. IMAGE CLARITY

- The repeatability is $\pm 0,5$.
- The display accuracy is 0,1.

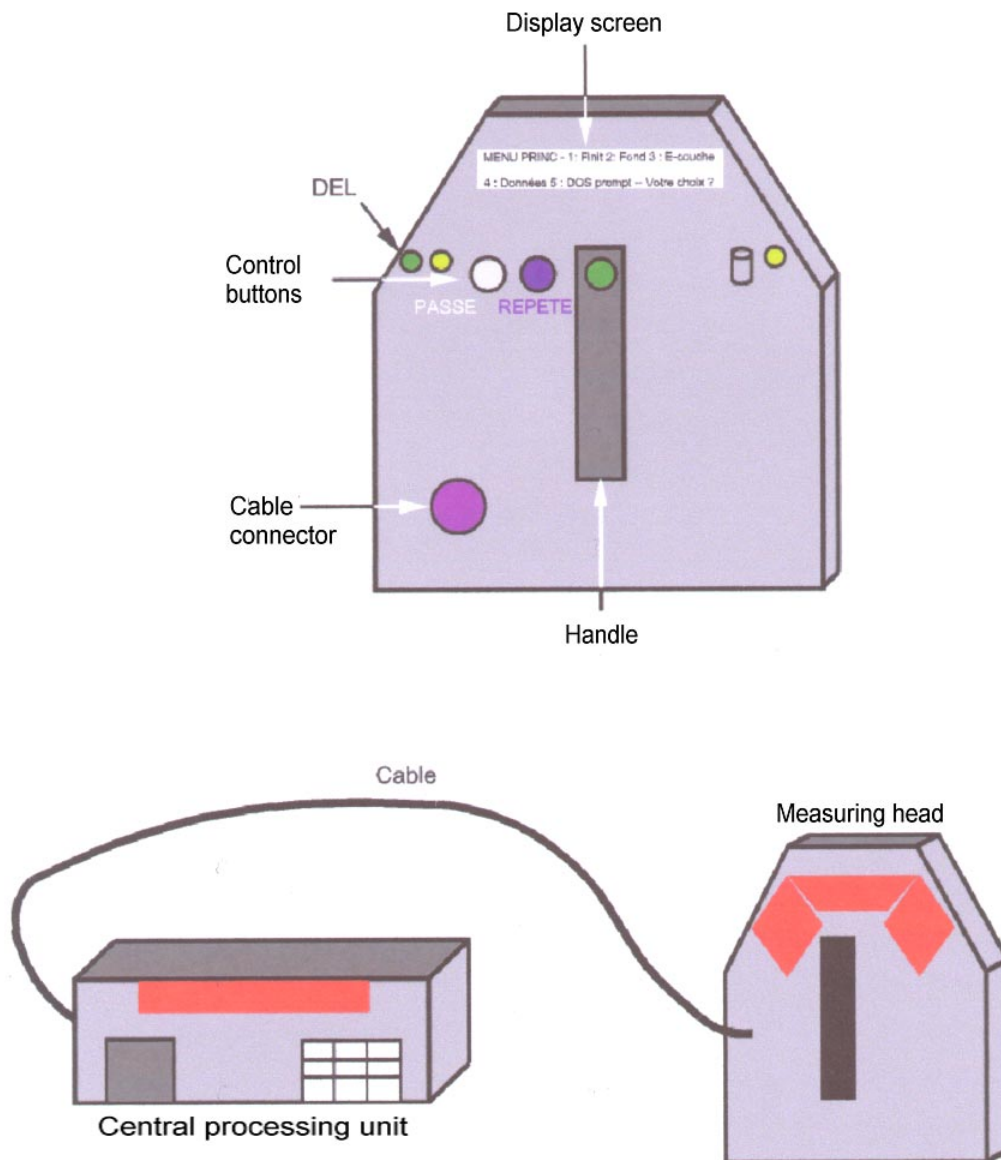
9. TEST REPORT

In addition to the results obtained, the test report must indicate:

- The reference to this méthode,
- The complete identification of the measured sample,
- The measurement location,
- The operational details not specified in the method as well as any possible incidents likely to have affected the results.

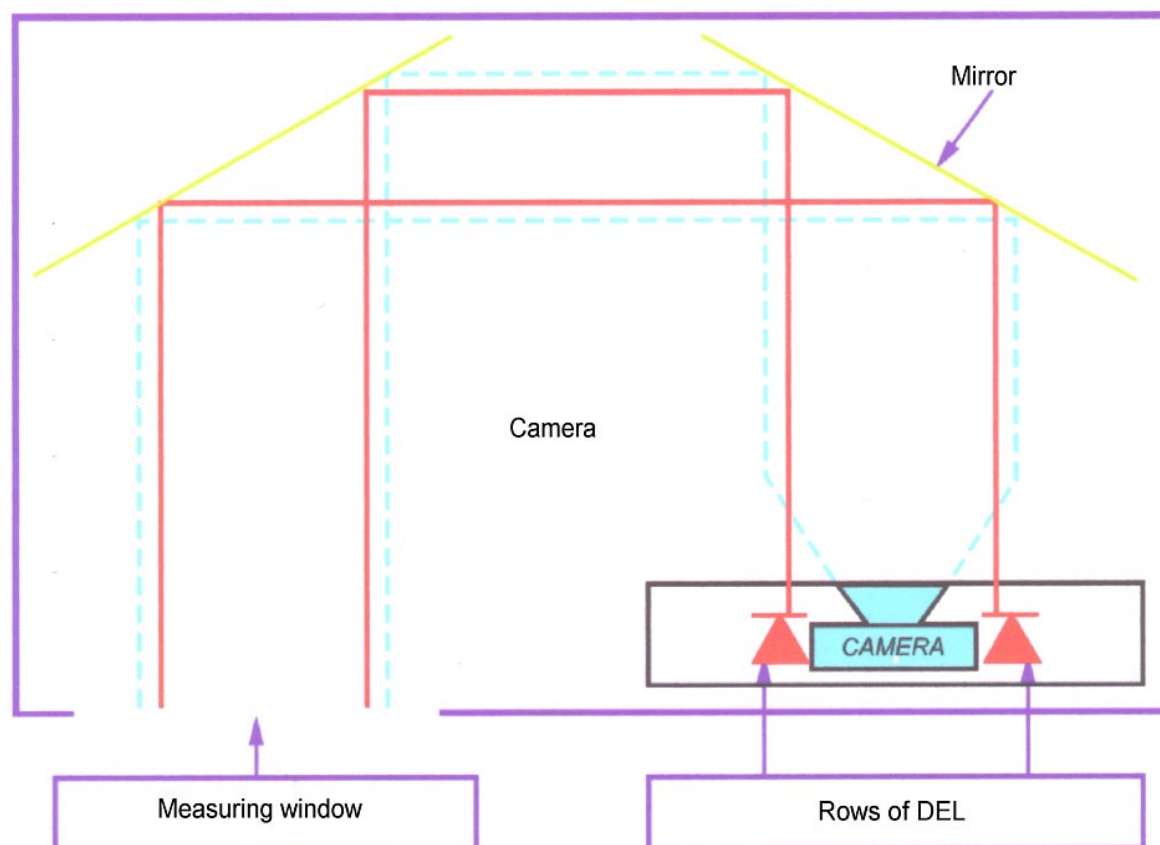
Appendix 1

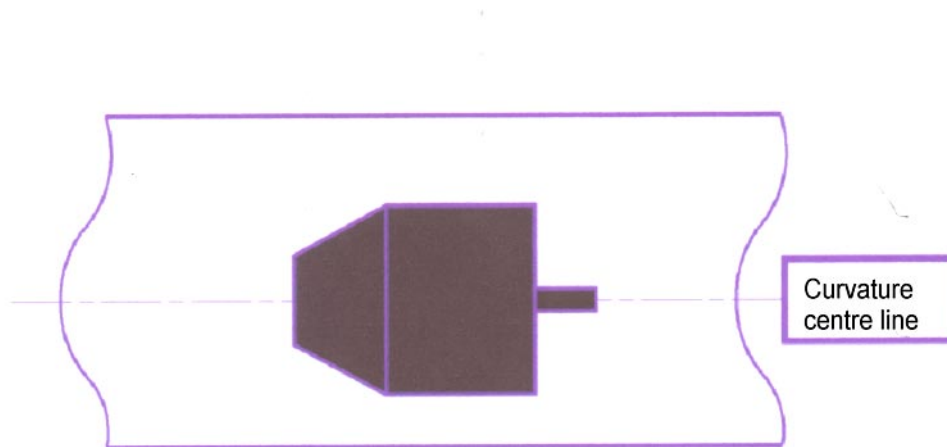
EQUIPMENT QMS BP +



Appendix 2

MEASUREMENT PRINCIPLE DIAGRAM



Appendix 3**POSITIONING OF THE EQUIPMENT**

10. RECORDS AND REFERENCE DOCUMENTS

10.1. RECORDS

10.1.1. CREATION

- OR : 14/12/2000 – CREATION OF THE METHODE D'ESSAI.

10.1.2. SUBJECT OF THE MODIFICATION

- A : 01/02/2002 – VALUES IN § 6.3.2. MODIFIED.
- OR : 14/12/2000 – CREATION OF THE METHODE D'ESSAI

10.2. REFERENCE DOCUMENTS

10.2.1.PSA DOCUMENTS

10.2.1.1 Normes

10.2.1.2. Others

10.2.2. EXTERNAL DOCUMENTS

10.3. EQUIVALENT TO :

10.4. CONFORMS TO :

10.5. KEY-WORDS