

GE  
Inspection technologies

# NDT Si

## Instruction manual



GE imagination at work

X-ray | Ultrasonics | Eddy Current | Testing Machines

NFH71/00200412



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## 1. GENERAL

### 1.1 NDT S i AND THE 'ECO' PRINCIPLE

The NDT S i is a developer machine which 100% merits its name.

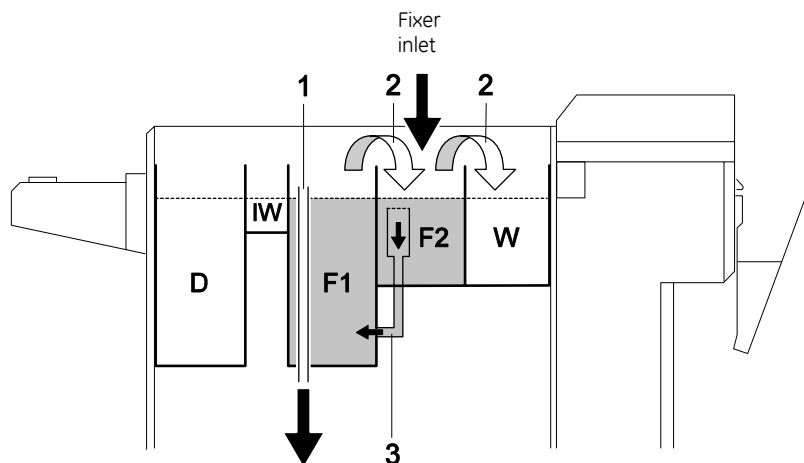
'S' stands for 'super' in terms of film quality, speed, the options available and the technology. NDT S i is an extension of the existing advantages of the NDT S (including the intermediate wash principle).

The second part of the name of 'i' is based on the 'improved film throughput capacity', achieved by the well-considered choice between highest film throughput speed and the rack length of the film processing system.

An additional technology plus of the NDT S i is the application of the dual-fixer tank principle (F1 and F2), also termed a fixer cascade. The dual-fixer tank principle, the so-called 'Eco' principle, has ecological as well as economic advantages\*:

- reducing the silver residues (or concentration) in the wash water,
- reducing the fixer regenerate,
- reducing the quantity of water.

*\* These advantages cannot always be combined with one another. It depends on the local circumstances regarding environmental protection. Therefore you should obtain advice from your local GE Inspection Technologies representative because he will be able to suggest the most appropriate combination for your situation.*



Developer tank (D)	1	Overflows
Intermediate wash tank (IW)	2	Transfer of residues
Fixer tank 1 (F1)	3	Link between F2 and F1 in the direction of F1
Fixer tank 2 (F2)		
Final wash tank (W)		

### 1.1.1 Reducing the silver residues (or concentration) in the wash water

Film is processed in the NDT S i developer machine as follows.

The exposed film passes a developer tank (D) and is then rinsed in the intermediate wash tank (IW). Because of the intermediate wash principle, the film carries almost no developer residues to the fixer tank. The intermediate wash principle also prevents film development errors from occurring. The effectiveness of the fixer is retained by means of which the film is 100% fixed in the first tank. The fixer tank F1 thereby has the higher silver content. The film then passes to the second fixer tank where fresh fixer regenerate is added. The film thus receives an extra rinsing in fresh fixer. The silver residues in this second fixer tank F2 will therefore be very low, with the result that the film carries the lowest possible quantity of silver when transferring from the fixer tank F2 to the final wash tank (W).

The film processing system of the NDT S i results in a silver content in the wash water that is up to 25 times lower than that in a conventional film processing system for developing, fixing and rinsing, without an intermediate wash.

The silver left in the wash water is up to 15 times lower than in the already more ecologically caring film processing for the developing, intermediate wash, fixing and the final wash.

On condition that the standard fixer regenerate of 600 ml/m<sup>2</sup> and the standard water quantity of 13 l/m<sup>2</sup> are maintained, the NDT S i offers the possibility of reducing the silver carried in the wash water to about 20 mg/m<sup>2</sup> film. This corresponds to a silver concentration in the final wash tank of about 1 part per million (ppm).

### 1.1.2 Reducing the fixer regenerate

Depending on the local legislation on environmental protection, it may be possible to reduce the quantity of fixer regenerate used. This can be done if the obligation to reduce residual silver (or silver concentration) in the wash water (see 1.1.1.) does not apply.

To find out more about this, please contact your local **GE Inspection Technologies representative**.

### 1.1.3 Reducing the water quantity

Depending on the local legislation on environmental protection, it may be possible to reduce the quantity of water used. This can be done if the obligation to reduce residual silver (or silver concentration) in the wash water (see 1.1.1.) does not apply.

To find out more about this, please contact your local **GE Inspection Technologies representative**.

## 1.2 SAFETY REGULATIONS

Always observe the following safety regulations:

- The machine must be set up at a place where it is continually under supervision and where improper use, especially by children, is excluded.
- The processor may not be installed in direct sunlight (max. 2500 lux).
- The machine must be set up perfectly level.
- Installation, trouble shooting and repairs of an electrical or mechanical nature, may only be carried out by a specialised **GE Inspection Technologies technician**.
- When handling chemicals, the safety regulations must be strictly observed. In this regard carefully read the instructions in and on the packaging. Protect your eyes from splashing of chemicals by wearing safety goggles. Always wear the prescribed protective clothing.
- When draining or dumping chemicals and wash water, you must abide by the local regulations and environmental legislation.
- The process chemicals must be collected separately.
- **GE Inspection Technologies** reserves the right to adapt the equipment to the latest technical specifications at any time.

## 1.3 INTERNATIONAL STANDARDS AND CERTIFICATES

The NDT Si machine meets the specifications of the following standards, regulations and guidelines:

- EN 60950 1997 (identical to VDE 805 and IEC 950)
- UL 122 Edition 3, 1993 and UL 1950 Edition 3, 1995
- cUL = CSA C 22.2 No. 950 –OM95
- EMC directives: 89/336/EEC and subsequent versions
- Machinery directives: 89/392/EEC and subsequent versions
- DIN 1988 part 4 and prEN 1717 (Technical rules for potable water)
- BS 6281 part 1 and prEN 1717 (prevention of contamination of water by backflow)

GE Inspection Technologies reserves the right to modify the devices in accordance with technical advances and the new versions of standards, regulations and directives.

Certificates and approval symbols:

- TÜV           GS
- UL, CSA       UL, cUL
- GE             CE



## 2. INSTALLATION

The NDT S i processor with the chosen accessories (see 10.1) is installed by a specialised **GE Inspection Technologies** technician.

When the NDT S i is installed, the default process parameters are set up in one of the twelve possible languages.

## 3. COMPONENTS AND FUNCTIONS

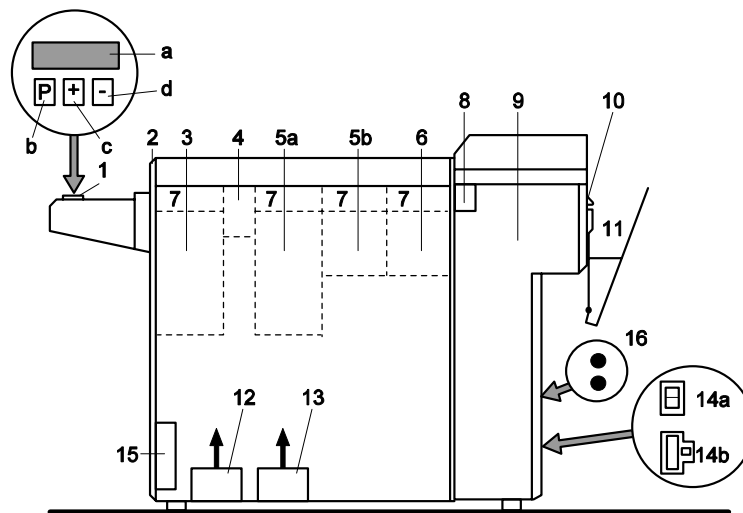


Fig. 1

- |  |   |
|--|---|
| 1 ..... Film feed table                | 7 ..... Removable upper racks                         |
| a..... LCD display                     | 8..... Distribution rollers                           |
| b..... Programme selection             | 9..... Infrared dryer                                 |
| c..... Increase the setting            | 10 ... Film output                                    |
| d..... Decrease the setting            | 11 ... Film receiving basket                          |
| 2 ..... Film sensors for replenishment | 12 ... Replenishment pump for developer               |
| 3 ..... Developer tank                 | 13 ... Replenishment pump for fixer                   |
| 4 ..... Intermediate wash tank         | 14a. On/Off switch                                    |
| 5a.... Fixer tank F1                   | 14b. Earth Leakage Circuit Breaker (ELCB)             |
| 5b.... Fixer tank F2                   | 15 ... Three-way taps for emptying the machine tanks  |
| 6 ..... Final wash tank                | 16 ... Overheating protectors for developer and fixer |

The process parameters of the NDT S i appear on the display of the control panel at the left side of the film feed table.

## 4. PLACING THE NDT S I INTO SERVICE

### 4.1 PREPARATION OF THE CHEMICALS

- Use only chemicals intended for automatic processing.

The NDT system is totally co-ordinated. Optimum film results can therefore only be attained by using NDT chemicals.

- We recommend that the chemicals be prepared in the NDT MIXER or in separate replenishment tanks (see accessories - 10.1).
- Carefully adhere to the preparation data on the packaging of the chemicals.
- Avoid any contact of fixer with developer.

### 4.2 FILLING THE MACHINE TANKS

- Place the drain taps in the operational position (see table 8.2).
- Remove the machine cover.
- Remove the upper racks by lifting them up by the handles on the sides (fig. 2).
- Remove the racks.
- First fill the fixer tanks F1 and F2 and then fill the developer tank. Fill the fixer tanks with ready-to-use fixer up to the marker line.

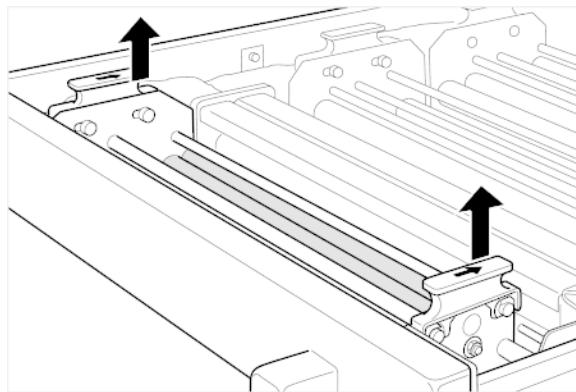


Fig. 2

#### **IMPORTANT:**

*Be careful that no fixer gets in the developer tank. If this should happen anyway, the developer tank must be completely cleaned after disposing of the spoilt chemicals.*

- Fill the developer tank with ready-to-use developer up to the marker line.
- Add starter solution (volume as recommended on the packaging) to the developer in the tank, while stirring continually.
- Place the racks carefully back into the corresponding tanks.
- Place the upper racks carefully back on the corresponding lower racks. Notice the arrow that indicates the film-transport direction (fig. 3).

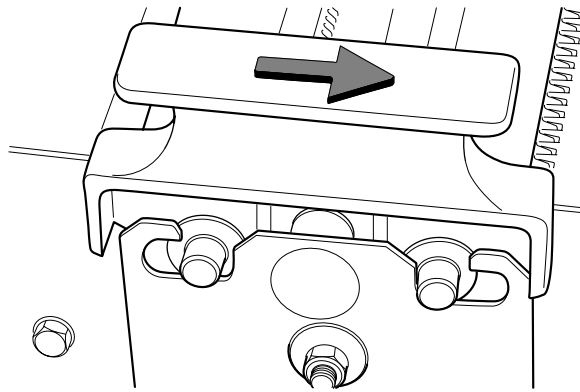


Fig. 3

**IMPORTANT:**

Notice the corresponding color indicators of the racks:

<i>Developer</i>	=	<i>red</i>
<i>Intermediate wash</i>	=	<i>black</i>
<i>Fixer: long rack (F1)</i>	=	<i>blue</i>
<i>short rack (F2)</i>	=	<i>blue</i>
<i>Final wash</i>	=	<i>white</i>

- Check, before inserting film, that the upper rack is correctly positioned. Be careful that the attachment pins of the upper rack, are firmly clamped to the lower rack (fig. 4).
- Replace the machine cover.
- Open the water supply.

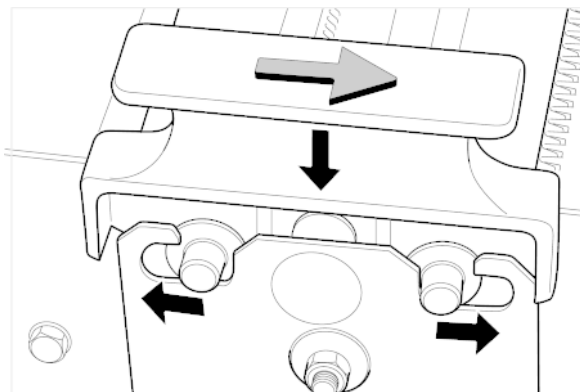


Fig. 4

**4.3 PLACEMENT INTO SERVICE**

- Place the On/Off switch and the circuit breaker in position I.
- The wash tank is filled automatically. At the same time, the warm-up phase for the developer and fixer begins. The fluid levels are monitored automatically and corrected (metering pump starts up).

#### 4.4 REGULAR CHECKS

Before starting to use the machine each day, check that:

- the replenishment tanks are sufficiently filled,
- the waste tanks still have sufficient receiving capacity,
- the water tap is opened,
- the racks are placed correctly in the machine,
- the machine cover is correctly closed,
- the film feed table is clean and dry,
- the film receiving basket is correctly positioned.

**IMPORTANT:**

*When the machine and dryer cover is open, **all current-drawing devices including film transport** are turned off automatically for safety reasons.*

## 5. OPERATION

In the example below, the temperatures quoted refer to the basic cycle (8 min).

### 5.1 WARM-UP PHASE

- On the display you see the current developer temperature:

e.g. DEV 79F flashing

After the developer temperature is reached, the following messages can appear if the fixer temperature or the level of the water has not yet been reached:

FIX 79F or LEVEL flashing alternately with WATER

Both messages continue flashing alternately, with the developer temperature reached appearing on the display.


- The following message indicates that both the set temperatures and the tank levels have been reached:

OK 82F

- The NDT S i is now ready for use.

### 5.2 FILM INSERTION

- The NDT S i by now is displaying the desired developer temperature of OK 82F.

By pressing the  key, the fixer temperature can be shown on the display for 5 seconds:

FIX 82F

- Insert 1 or 2 large sheets of cleaning film before the first actual exposure is processed. An undeveloped NDT film that is date-expired may be used as a cleaning film. Repeat the procedure until the last cleaning film was processed without error.

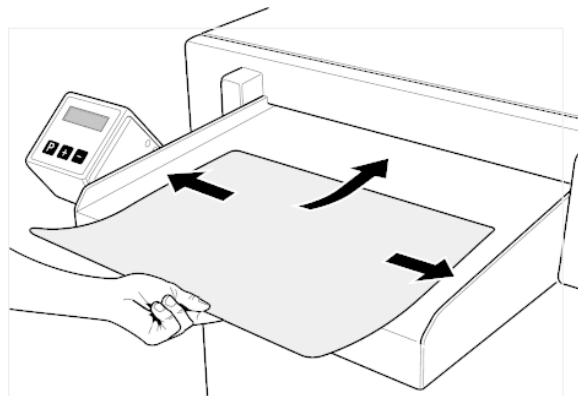


Fig. 5

- With a forward motion and with a light pressure, the film is pushed straight into the insertion slot (fig. 5).
- Small films can be inserted straight in next to each other and are developed.
  - e.g.: 6 films of 6 cm width
  - 5 films of 7 cm width
  - 4 films of 10 cm width
- Roll film is always inserted with the memory curl down. A few recommendations:
  1. Be sure that the leading edge of the film has rounded corners.
  2. When inserting the film make sure it is kept as straight as possible.
  3. Maximum 6 films may be inserted next to each other.

During the insertion of the film, the following message appears on the display:

-- FILM --

To insert new film(s) you must wait until you hear a short signal tone and see the following message on the display:

OK 82F

- Now you can insert additional films.
  - After inserting the last film, 8 lines and the OK temperature message appear alternately:
    - alternating with OK 82F.
- Fewer lines are displayed as developing progresses.

### Films that may be processed

The NDT S i can process industrial x-ray films of all common brands. Both sheet films and roll films can be developed.

- smallest format 6 x 12 cm
- minimum width 3.5 cm
- minimum length 12 cm
- maximum width 43.2 cm
- maximum length 500 cm
- film curl: minimum diameter 30 cm

The receiving basket of the NDT S i is double. This enables it to be placed in three positions, depending on the film format and the application (fig. 6, fig. 7, fig. 8):

In the default set-up (fig. 6), all film formats can be processed, mixed together (the angle of the basket relative to the machine is 30°).

In the set-up in fig. 7 the developed sheets of film can be stacked by means of adjustable guide blocks. For each path, only one film format is possible.



For roll film, one must place the basket in the position indicated in fig. 8 (the angle of the basket relative to the machine is 60°).

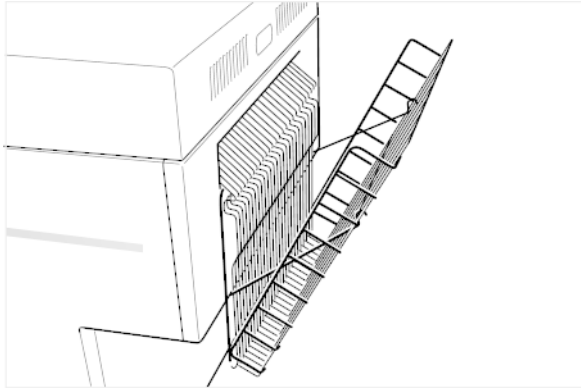


Fig. 6

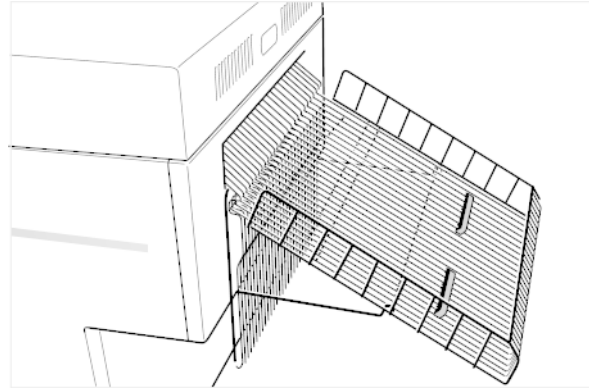


Fig. 7

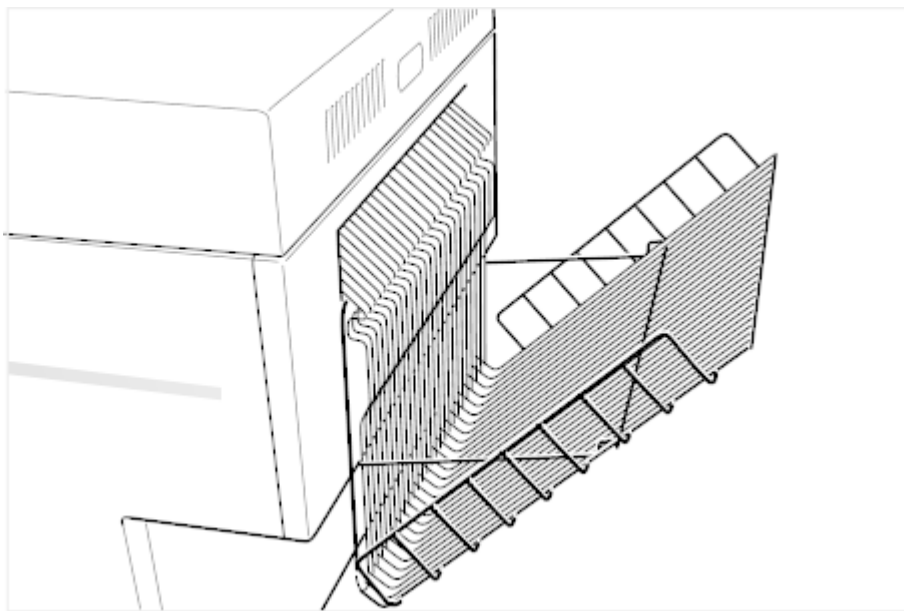


Fig. 8

### 5.3 URGENTLY REQUIRED FILM

Once the developer and fixer levels **have been reached**, an urgently required, or priority, film can be developed (see 5.3.2) when:

- the set temperature for developer and/or fixer **has not yet been reached**,
- the water level of the water tank **has not yet been reached**,\*
- the level in the replenishment tank(s) **is too low**,
- the waste tank(s) is (are) **full**,
- the level of the anti-algae tank **is too low** (if fitted),
- the mixer level **is too low**.

\*Always check to be sure there is a water supply. With a closed water-inlet tap, no intermediate wash will take place; this results in high pollution of the fixer by the amount of developer that is carried along with each film. If the water level of the final wash tank has not been reached, blockage of a film, and damage to the processor, can occur.

#### **IMPORTANT:**

*The developing, the fixing and the washing of priority films will not produce optimum results and should therefore only be used in case of emergency.*


*With continued insertion of priority films, it is possible that the fixer will not be warmed up. As a result, the archivability of the films is not guaranteed and must therefore definitely be checked.*

#### 5.3.1 Messages on the display

On the display the following messages will flash after switching on the NDT S i:

DEV 79F			Temperature of developer not yet reached.
FIX 79F			Developer OK but fixer temperature not yet reached.
LEVEL	alternating with	WATER	Developer and fixer temperature OK, wash water level not yet reached (after 6 min.).
REPLEN.	alternating with	DEVELOP.	Developer replenishment tank level too low.
REPLEN.	alternating with	FIXER	Fixer replenishment tank level too low.
REPLEN.	alternating with	ANTI-ALG	Anti-algae product replenishment tank level too low (when installed).
WASTE	alternating with	DEVELOP.	Developer waste tank full (when installed).
WASTE	alternating with	FIXER	Fixer waste tank full (when installed).
MIXER	alternating with		NDT Mixer empty (add fixer or developer) (when installed).



### 5.3.2 Insertion of the urgently required film

- Press the  key to insert a priority film. The following message appears on the display: PRIORITY
- Insert the priority film after which the following message appears on the display: -- FILM -- flashing

#### **IMPORTANT:**

*It is not possible to run a priority film through if the developer and/or fixer level have not been reached. The following appears on the display: LEVEL alternating with DEVELOP. or LEVEL alternating with FIXER.*

If printing is done anyway, no priority-film message will follow. As a result no film can be inserted.

- As long as the film sensor is registering the film, then, as in normal film insertion, the message -- FILM -- will be shown flashing on the display.
- After the priority film is inserted in the processor, the cause of Not OK (see 5.3.1) is shown alternately with the film position dashes. Both messages are shown flashing.  
e.g. DEV 79F alternately -----
- As long as the display with the film position dashes is also shown alternately, new priority films can be inserted without pressing the  key.
- Once the last priority film has gone into the film receiving basket, the current machine state will be displayed again (OK 82F or display of Not-OK messages - see 5.3.1) followed by a signal tone.
- A new priority film can only be inserted from the Not OK messages on the display when the  key is pressed.
- If OK 82F appears on the display, the priority-film procedure is cancelled.

### 5.4 JOG CYCLE

In standby with the jog cycle activated the motor will run every 8 minutes thus activating the transport rollers. The setting for working with or without a jog cycle can be made at the request of the customer during the installation of the machine by the **GE Inspection Technologies service technician**.

## 6. MODIFYING PROCESS PARAMETERS

Via the control panel, the NDT S i makes it possible to easily adjust the process parameters as desired and depending on the work conditions.

A specialised **GE Inspection Technologies service technician** will set up the following options, according to the needs of the user during installation of the NDT S i.

### **BASIC CYCLES**

A selection from 7 cycles in which the process parameters are automatically and optimally co-ordinated with each other.

The process parameters can be set according to one's own needs (see table 6.1).

The standard cycle for the European GE Inspection Technologies film classification (CEN) is the 8-minute cycle (100 sec. Immersion time, developer temp. 82°F).

or

### **VARSPPEED**

On the basis of the parameter setting of the standard cycle, the cycle time can be modified as desired in steps of 30 sec. between 1.5 min. and 12.5 min. The developer temperature is not automatically adapted.

The setting of the option: VARSPPEED should be carried out by a specialised **GE Inspection Technologies service technician**.

### **PASSWORD**

The process parameters in both options can be protected against unwanted modifications by setting a three-number code, also called a password.

### 6.1 MODIFYING PROCESS PARAMETERS IN THE OPTION: BASIC CYCLES

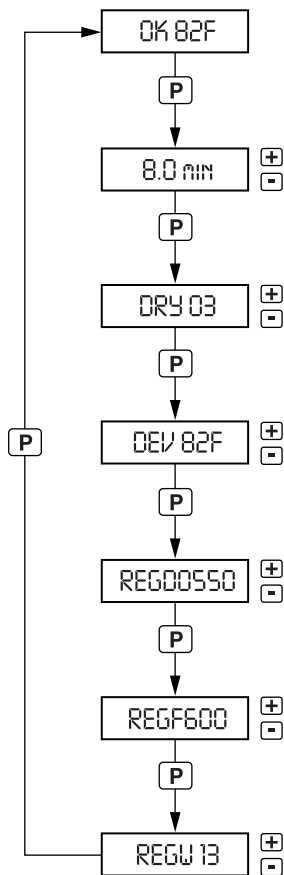
A selection can be made from 7 process cycles.

The NDT S i is supplied in the standard cycle (8 min/Developer temperature = 82°F).

<i>Cycle time</i>	<i>Dryer</i>		<i>Temperature</i>		<i>Replenishment</i>		
	<i>setting</i>	<i>Setting range</i>	<i>Devel.</i> °F	<i>Fix.</i> °F	<i>DEVEL.</i> ml/m <sup>2</sup>	<i>FIX.</i> ml/m <sup>2</sup>	<i>WATER</i> l/m <sup>2</sup>
12.0	2	1 - 10	77	82	900	1200	13
10.0	5	1 - 12	79	82	900	1200	13
<b>8.0</b>	<b>8</b>	<b>1 - 15</b>	<b>82</b>	<b>82</b>	<b>900</b>	<b>1200</b>	<b>13</b>
6.0	11	1 - 17	86	86	900	1200	13
5.0	11	1 - 17	88	88	900	1200	13
2.5	14	1 - 20	97	97	600	800	10
1.5	16	1 - 20	97	97	600	800	10

- With the **P** key you run through the various parameters:
  - Process,
  - Dryer setting,
  - Developer temperature,
  - Replenishment amounts of developer, fixer and water.
- With the **+** or **-** key, the parameter data are modified as desired. The process speed can not be changed during film transport, however.

The following diagram shows the procedure for changing the process data in the standard cycle:



If within 5 seconds no key is pressed, the Start display appears automatically: OK 82F. This locks the set values.

Press the **+** key to get a higher setting.  
Press the **-** key to get a lower setting.

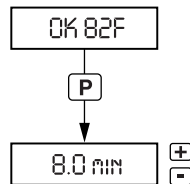
Changes will be adopted automatically after 5 seconds and the Start display OK 82F will appear.

### 6.1.1 Adjusting the cycle time

Modification of the process cycle can be done very simply with the NDT S i via the display.

**IMPORTANT:**

The cycle time can not be changed during film transport!



E.g. 10.0 min

The Start display indicates the developer temperature.

Press the **P** key once.

The setting of the process cycle appears on the display.

Press the **+** key to get a longer cycle.

Press the **-** key to get a shorter cycle.

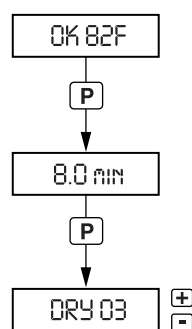
E.g.: Press the **+** key once to change to the 10 min. cycle.

**IMPORTANT:**

When you change the cycle, the developer and fixer temperatures, and the dryer setting are automatically adjusted. In the example given, the machine will go into the cooling phase, because the developer temperature setting of the 10 min. cycle is 79°F. As long as this temperature has not been reached, the current developer temperature is shown flashing on the display. The fixer temperature remains minimum 82°F. Once the programmed developer temperature has been reached, the following display appears: OK 79°F.

### 6.1.2 Modifying the dryer setting

The dryer of the NDT S i has 20 dryer levels. Each basic cycle has its standard dryer setting, which is adjusted automatically. The dryer setting can be modified by pressing the **+** or **-** keys. The adjustment range is determined by the basic cycle, as shown on the overview table under point 6.1.

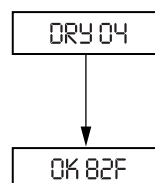


The Start display indicates the developer temperature.

The standard cycle appears on the display.

Press the **+** key to get a higher setting.

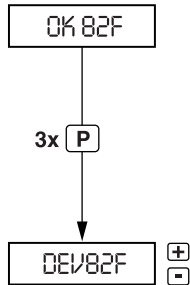
Press the **-** key to get a lower setting.



E.g.: If the **P** key is not pressed again within 5 seconds, the Start display automatically appears again. The new dryer value is then set.

### 6.1.3 Setting the developer temperature

The recommended basic cycle for the developing of industrial x-ray films is 8 minutes at 82°F developer temperature. Proceed as follows to change the developer temperature:



Start display.

Press the **P** key three times. The temperature setting appears on the display.

Press the **+** or **-** key to increase or decrease the developer temperature in steps equivalent to 1°C (equal to 1 or 2°F). The temperature can be set between 68 and 104°F.

#### IMPORTANT:

For a cycle time where the developer temperature is low (e.g. 10 min at 79°F), during the cooling period, the developer temperature will be shown on the display. When the developer temperature setting has been reached, the display automatically changes to: OK 79F.

To insert films without running the risk of getting sensitometric shifts, one must wait until the developer temperature is correct. The fixer temperature may still be too high, however.

If the developer temperature is changed during film transport, (e.g. to 89°F) then the NDT S i tries to reach this new temperature during the film transport phase (warming or cooling).

**Carrying out temperature changes during film transport can influence the sensitometric characteristics of the film concerned.**

In the following diagram, the temperature is reduced from 82° to 79°F.

- On the display appears: -- FILM -- flashing.
- When the film is inserted and the modified developer temperature has not yet been reached then flashing DEV 81F alternating with - - - - - until the film has left the machine.
- After the newly set temperature is reached, the following messages can appear on the display:
  - If more film is inserted -- FILM --
  - If film is inserted the signal tone sounds OK 79F alternating with - - - - - as long as there is still film in the machine
  - If there is no more film in the machine: OK 79F.

If the film has left the developer machine before the developer has reached the set temperature, the display will flash and show the actual developer temperature: e.g. DEV 80F flashing.

During a started process cycle, film can continually be inserted. Once the last film has left the developer machine and the display does not yet show OK 79F, one can only insert film by means of a new priority-film procedure (see 5.3).

### 6.1.4 Changing the replenishment amounts

The standard replenishment amounts are:

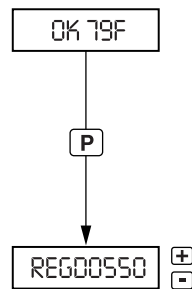
- 900 ml/m<sup>2</sup> for developer shown on the display as REGD0900
- 1200 ml/m<sup>2</sup> for fixer shown on the display as REGF1200
- 13 l/m<sup>2</sup> for wash water shown on the display as REGW 13

For developer and fixer replenishment, the setting is done in ml/m<sup>2</sup> in steps of 50 ml, adjustable between 200 and 1500 ml/m<sup>2</sup>.

The water quantity is set in l/m<sup>2</sup>, in steps of 1 litre, adjustable between 10 and 30 l/m<sup>2</sup>.

For the default settings see the overview table in 6.1.

Proceed as follows to change the replenishment:



Press the **P** key 4 times to modify the **developer replenishment**.

(To modify the **fixer replenishment**, press the **P** key 5 times.)

(To modify the **water quantity**, press the **P** key 6 times.)

The replenishment amount setting for the **developer** appears on the display:

Press the **+** or **-** key to increase or decrease the developer or **fixer replenishment** in steps of 50 ml.

The **water quantity** is modified in steps of 1 litre.

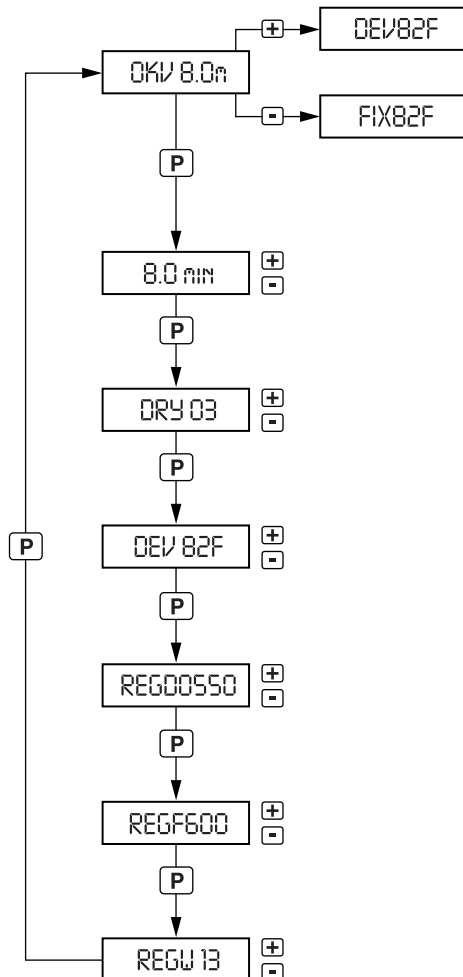
## 6.2 MODIFYING PROCESS PARAMETERS IN THE OPTION: VARSPEED.

- By selecting the option VARSPEED during installation it is possible to change the cycle time in steps of 30 seconds.
- The adjustment range is from 1.5 to 12.5 minutes.
- The dryer setting and the fixer temperature are automatically adjusted in the cycles between 5 and 12.5 min. The dryer level can however always be adjusted separately if necessary (see 6.1.2).
- The other process parameters are not influenced by this change.
- All parameters can however be modified separately as desired by pressing the  $\oplus$  or  $\ominus$  key. The following table shows the setting values for the option: VARSPEED:

<i>Process time</i> <i>min.</i>	<i>Dryer level</i>	<i>Dryer adjustment range</i>	<i>Devel. temp.</i>  <i>°F</i>	<i>Fixer temp.</i>  <i>°F</i>	<i>Replen. devel.</i> <i>ml/m<sup>2</sup></i>	<i>Replen. fixer</i> <i>ml/m<sup>2</sup></i>	<i>Replen. water</i> <i>l/m<sup>2</sup></i>
12.5	2	1-10	82	82	900	1200	13
12.0	2	1-10	82	82	900	1200	13
11.5	3	1-11	82	82	900	1200	13
11.0	3	1-11	82	82	900	1200	13
10.5	4	1-12	82	82	900	1200	13
10.0	5	1-12	82	82	900	1200	13
9.5	5	1-13	82	82	900	1200	13
9.0	6	1-13	82	82	900	1200	13
8.5	7	1-14	82	82	900	1200	13
<b>8.0</b>	<b>8</b>	<b>1-14</b>	<b>82</b>	<b>82</b>	<b>900</b>	<b>1200</b>	<b>13</b>
7.5	9	1-15	82	82	900	1200	13
7.0	10	1-15	82	84	900	1200	13
6.5	11	1-16	82	86	900	1200	13
6.0	11	1-16	82	86	900	1200	13
5.5	12	1-20	82	88	900	1200	13
5.0	12	1-20	82	88	900	1200	13
4.5	13	1-20	97	97	600	800	10
4.0	13	1-20	97	97	600	800	10
3.5	14	1-20	97	97	600	800	10
3.0	14	1-20	97	97	600	800	10
2.5	15	1-20	97	97	600	800	10
2.0	15	1-20	97	97	600	800	10
1.5	16	1-20	97	97	600	900	10

The VARSPEED option is indicated on the display by an additional V. E.g. OKV 8.0m

The following diagram shows the procedure for changing the process data in the VARSPEED option:



Developer and fixer temperature can only be consulted in this phase, but not modified.

If no other key is pressed within 5 sec. The Start display OKV 8.0M appears again and the set values are locked. By pressing the  $\oplus$  or  $\ominus$  keys, higher or lower values are set.

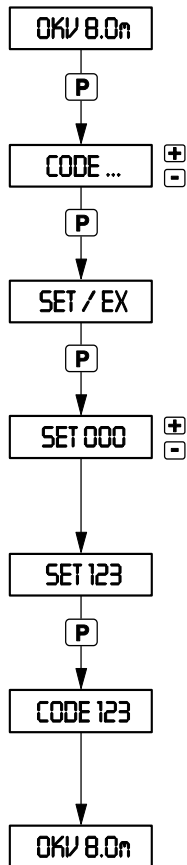
Changes will be adapted automatically after 5 seconds and the Start display OKV 8.0m will appear.

### 6.3 WORKING WITH PASSWORD PROTECTION

Both the BASIC CYCLES and the VARSPEED options can be protected against modifications by the entry of a three-number code, also called a password. This option has to be selected during installation. If you have forgotten the code, it can be found with the service programme by a specialised **GE Inspection Technologies technician**.

#### 6.3.1 Entry of the PASSWORD

The following diagram is an example in the option: VARSPEED.



Hold the **P** key down for 5 seconds.

Enter 000. This is the code that is set on delivery.

If no other key is pressed within 5 seconds, the Start display appears automatically and the code 000 remains set.

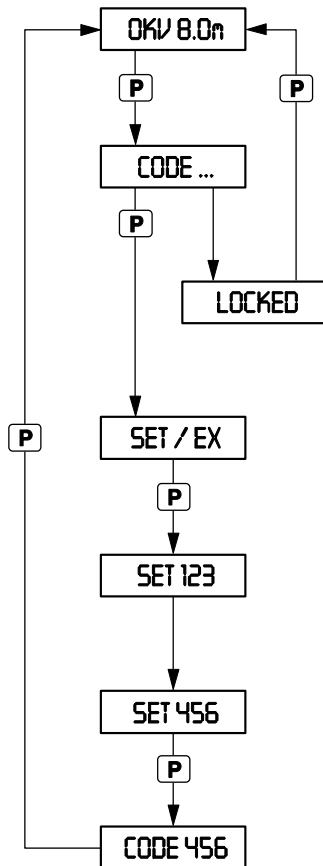
Form a new code with the **+** and **-** keys: e.g.123.

This display flashes three times and is followed by a signal tone as confirmation of the newly entered code.

**COMMENT:**

If within 10 seconds after leaving the menu, the **P** key is held down for 5 more seconds, the display will jump directly to SET/EX without one having to enter the code again.

### 6.3.2 Modification of the PASSWORD



Hold the **P** key down for 5 seconds  
If no other key is pressed within 5 seconds, the Start display appears automatically.

With the **+** and/or **-** keys enter the existing code: e.g. 123

Incorrect code entered. No changes possible. Press **P** key to return to the Start display.

The current, correct code (123) is entered.

Form a new code with the **+** and/or **-** keys: e.g. 456.

This display flashes three times and is followed by a signal tone as confirmation of the newly entered code.

#### COMMENT:

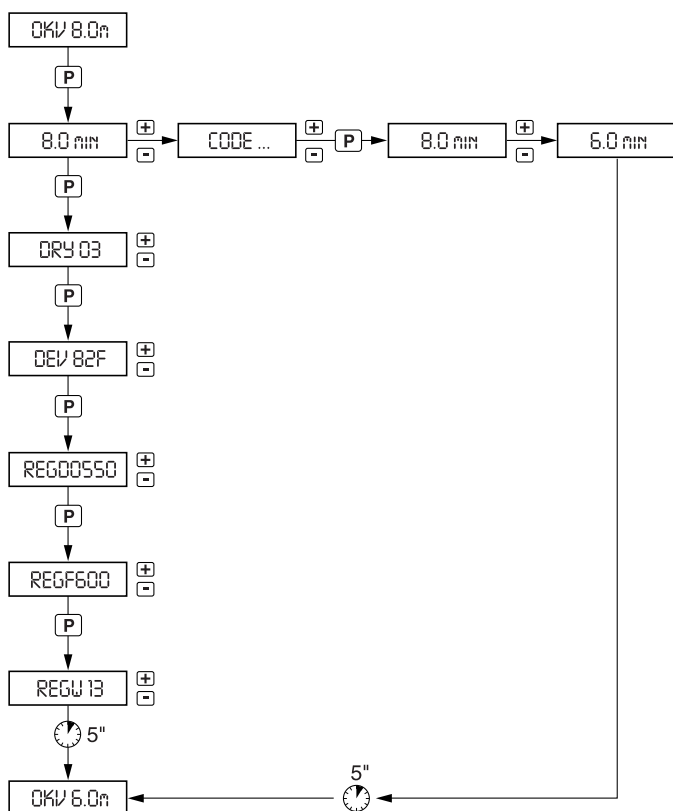
If within 10 seconds after leaving the menu, the **P** key is held down for 5 more seconds, the display will jump directly to SET/EX without one having to enter the code again.

### 6.3.3 Modification of process parameters under PASSWORD protection

- If it is required that the established process parameters may not be modified, except by authorised persons, PASSWORD protection can be set up by setting a number code.
- This code number must be entered once for the process parameter one wants to modify. Only the dryer setting can be modified without entry of the code.
- When the **P** key is pressed briefly at the Start display, the processor goes to the first changeable parameter: the cycle time.
- Within 5 seconds a key must be pressed to prevent the processor from returning to the Start display.
- Press the **+** or **-** key and the word, CODE... appears on the display.
- Enter the code by means of the **+** or **-** key.
- The cycle time appears on the display again and can be modified with the **+** and/or **-** keys.
- If other process parameters are also to be adjusted, one must press the **P** key again within 5 seconds (before the Start display is shown again). Then one can modify the parameter data immediately without having to enter the password again.
- 5 seconds after setting the data, the processor returns to the Start display. The new process parameters are then automatically locked. Then new modifications are only possible by going through the whole procedure again, including entry of the password.

Example 1: cycle time must be changed from 8 min to 6 min.

(The following diagram has been produced for the option: VARSPEED).

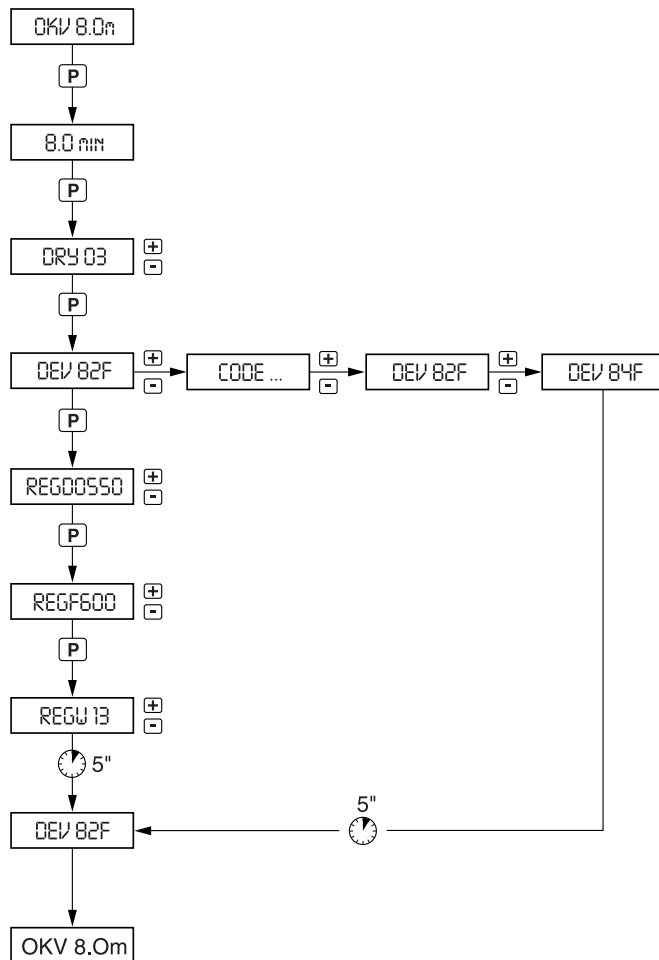


Dryer setting can be changed without code entry

By pressing the **P** key within 10 sec. after the last entry, one can modify the other process parameters without having to enter the code again.

Example 2: Developer temperature must be changed from 82° to 84°F.

(The following diagram has been produced for the option: VARSPEED).



Dryer setting can be changed without code entry.

Flashing until the developer temperature is 84°F.

## 7. TROUBLE SHOOTING

**IMPORTANT:**

Only a specialised **GE Inspection Technologies technician** can repair electrical or mechanical malfunctions.

For the following malfunctions, a message appears on the display and each second a signal tone sounds (it can be turned off during installation). Some malfunctions can/may only be repaired by a specialised GE Inspection Technologies technician.

Error	Message	Cause	Solution* / corrected by...
Temperature of developer more than 4°F off.	DEV.TEMP TOO HIGH	-Temperature regulation defective. -Triac-card defective.	GE Inspection Technologies service technician. GE Inspection Technologies service technician.
Temperature of developer increases less than 2°F within 12 min. Temperature of developer more than 4°F too low.	DEV.TEMP TOO LOW	-Overheating protection for developer turned off. -Heating element defective. -Triac-card defective.	Turn protection back on (fig.1 and fig. 9). GE Inspection Technologies service technician. GE Inspection Technologies service technician.

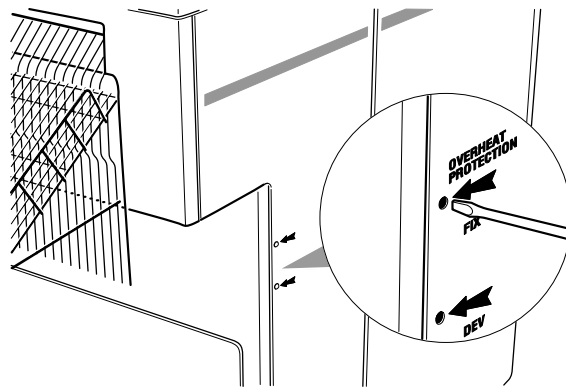


Fig. 9

Fixer temperature more than 102°F.	FIX.TEMP TOO HIGH	-Temperature regulation defective. -Triac-card defective.	GE Inspection Technologies service technician. GE Inspection Technologies service technician.
Fixer temp. below 82°F after warm-up phase. After 12 min. warming, the temp. has risen less than 2°F. In stand-by the temperature drops below 81°F.	FIX.TEMP TOO LOW	-Overheating protection for fixer turned off. -Heating element defective. -Triac-card defective.	Turn protection back on (fig. 1 and fig. 9). GE Inspection Technologies service technician. GE Inspection Technologies service technician.

Drive motor speed film transport deviates greatly from the set value.	SERV 506 □ **	-Drive element is not running smoothly. -Motor defective. -Motor regulation defective.	GE Inspection Technologies service technician. GE Inspection Technologies service technician. GE Inspection Technologies service technician.
Developer level is not reached.	LEVEL DEVEL.	-Replenishment pump, Triac-card or level sensor defective. -Drain tap open.	GE Inspection Technologies service technician. Close drain tap.
Fixer level is not reached.	LEVEL FIXER	-Replenishment pump, Triac-card or level sensor defective. -Drain tap open.	GE Inspection Technologies service technician. Close drain tap.
Water level is not reached. (Wash tank fills faster than the developer and fixer warm-up. When after 6 minutes the water level has not been reached an error message appears)	LEVEL WATER	-Supply tap closed.  -Magnetic drain vent defective. -Magnetic vent of water supply defective or plugged up. -Triac-card or level sensor defective.	Open supply tap. Turn machine off and back on (otherwise the magnetic vents remain closed). Check the water supply. GE Inspection Technologies service technician. GE Inspection Technologies service technician. GE Inspection Technologies service technician.
Replenishment tank of developer (option) is empty.	REPLEN. DEVEL.		Add developer.
Replenishment tank of fixer (option) is empty.	REPLEN. FIXER		Add fixer.
Replenishment tank of anti-algae (option) is empty.	REPLEN. ANTI-ALG		Add anti-algae product.
Mixer is empty	MIXER □ **		Prepare new developer and/or fixer in mixer.
Developer waste tank (option) full.	DEVELOP WASTE		Empty developer waste tank.
Fixer waste tank (option) full.	FIXER WASTE		Empty fixer waste tank.

\*To be corrected by the user himself.

\*\*Blank display.



## 8. MAINTENANCE AND CLEANING

### 8.1 MAINTENANCE

Only by carrying out regular maintenance and cleaning can you expect optimal film results. This will guarantee that the silver content of the water stays below the prescribed limit.

Correct functioning by the NDT S i principle can only be guaranteed if the machine is regularly serviced by a qualified **GE Inspection Technologies service technician**.

#### Film volume

Customers with a low daily film consumption (<5m<sup>2</sup>) must clean more often.

$$\begin{aligned} 5\text{m}^2 &= 33 \text{ films of } 14'' \times 17'' \text{ format} \\ &= 100 \text{ films of } 10 \times 48 \text{ cm. format} \end{aligned}$$

#### Periods of stoppage

1. After a relatively short period of stoppage (1/2 hour to a few hours) it is sufficient to insert a few cleaning films to clean the rollers of the processor.
2. After a stoppage of a day or a night it becomes necessary to clean the upper rack with a damp sponge and to insert some cleaning films.
3. After a stoppage of a few days to a week, the processor must be completely cleaned. If necessary, contact a GE Inspection Technologies technician for this.

### 8.2 CLEANING

The NDT S i is specially designed for simple and fast cleaning:

- removable upper racks
- drain taps for the selective draining of the process chemicals, wash water and cleaning products (see drawing of three-way tap fig. 10).

Practical:

- To simplify cleaning, it is necessary that there be a cleaning basin with a sprayer in the vicinity of the NDT S i (recommended dimensions: 100 x 60 x 15 cm).
- Do not use hot water when cleaning the machine tanks (for the sake of the overheating protector of the machine tanks)!

The maximum allowed temperature is 104°F!

- During cleaning, place the drain taps in the closed  position

#### **IMPORTANT:**

*Always heed the safety and environmental regulations when you handle chemicals. Also always wear the prescribed protective clothing.*

*Do not use the sprayer to clean the NDT S i tanks. Liquid running along the outside of the tanks may cause electrocution.*

### 8.2.1 Emptying the machine tanks

(See drawing of the three-way tap fig. 9).

To let the machine tanks empty out separately, especially when cleaning, you must take the nature (pH) of the products into consideration.

GE Inspection Technologies supplies the following cleaning products that provide you with adequate cleaning:

**Developer zone**

DEVCLEAN

**Fixer zone**

FIXCLEAN













**Wash zone**

FIXCLEAN (can also be used against algae and calcium)

*If you use other cleaning products, we recommend that you contact customer care at the GE Inspection Technologies branch responsible for you to discuss the correct positioning of the drain tap.*



The following table gives you an overview of the adjustment positions of the drain taps, so the liquids can be collected in a safe manner.

FUNCTION OF DRAIN TAPS	DEVELOPER TAP		FIXER TAP (1 and 2)		WASH WATER TAP	
	position	drain to	position	drain to	Position	Drain to
<b>TANK DRAIN CLOSED</b>	closed 	via overflow in developer. Waste tank.	closed 	via overflow in fixer waste tank	closed 	via overflow in sewer
<b>NORMAL POSITION (operational position)</b>		via overflow		via overflow	anti-alg 	via overflow
<b>EMPTYING TANKS filled with process chemicals)</b>	red 	developer waste tank	blue 	fixer waste tank		in sewer after turning off the machine
<b>EMPTYING TANKS (after cleaning with...)</b>						
<b>DEVCLEAN</b>	blue 	fixer waste tank				
<b>FIXCLEAN</b>			red 	developer waste tank		
<b>FIXCLEAN</b>						developer waste tank

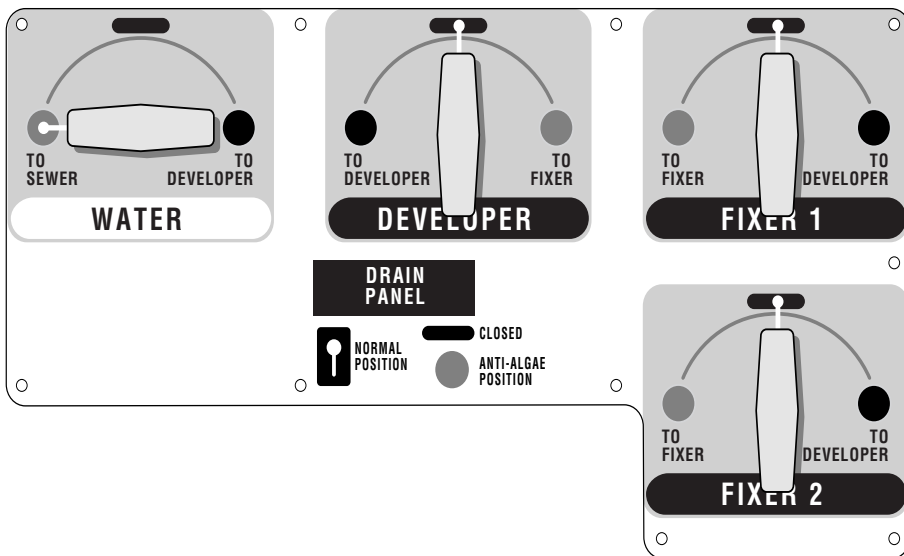


Fig.10

To prevent build-up of algae, the NDT S i has as standard a magnetic vent that empties the water tank automatically when the device is switched off.

### 8.2.2 Cleaning the feed table (to prevent impurities or scratches on the film).

- Clean the feed table with a damp sponge or lint-free cloth.
- Wipe the feed table dry.

### 8.2.3 Cleaning the upper racks

- Remove the machine cover from the NDT S i.
- The motor and controls of the developer machine switch themselves off.
- Remove the upper rack.
- Clean this upper rack with a damp sponge and then rinse it off.
- Avoid contamination of fixer in developer. For this reason, first clean the rollers in the developer section. Afterwards, rinse out the sponge thoroughly before cleaning the fixer rollers.
- Place the upper rack back on the corresponding lower rack (heed color indicator). Notice the arrow that indicates the film-transport direction. Check that the attachment pins of the upper rack are firmly clamped to the lower rack.
- Replace the machine cover.

### 8.2.4 Cleaning the film surface sensor

- Undo the fixing screws of the feed table and remove it.
- Remove the cover.
- Pull the film sensor upwards and remove it from the holder.
- Clean the film sensor with the film detection rollers and the holder with a damp sponge or a lint-free cloth (fig. 13).
- Carefully dry off the whole unit. The rollers may seize if liquid is spilled on them.
- Clean the feed table, including the sensor section.
- Place the film sensor back into the holder and be sure that the film sensor is firmly attached on both sides (press down firmly).
- Replace the cover.
- Remount the feed table and fasten it with the screws.

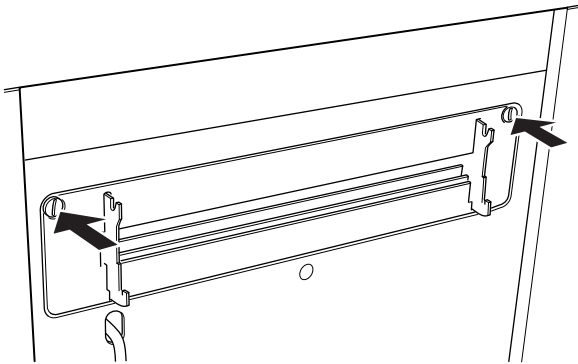


Fig. 11

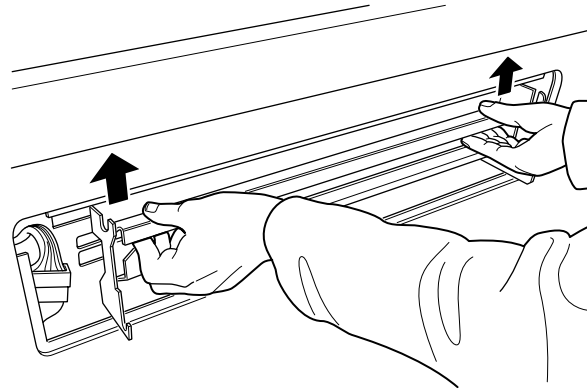


Fig. 12

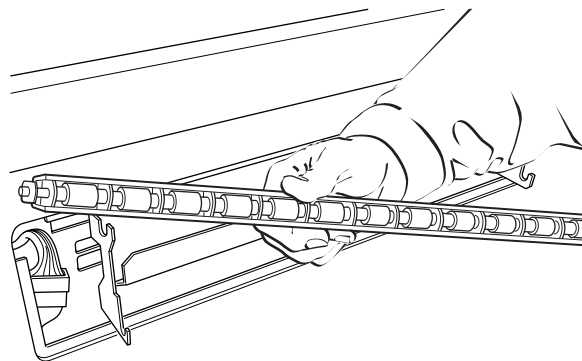


Fig. 13

### 8.2.5 Cleaning the transport racks

- Turn off the NDT S i.
- Remove the machine cover.
- Remove the upper racks.
- Lift the transport racks carefully out of the tanks.
- Carefully clean the upper and lower racks with a soft sponge under running water. This will not remove the silver layer that is on the rollers of the developer rack.
- When they are very dirty, you can use special cleaning agents. Only use the recommended cleaning agents or abrasive free, neutral soaps.
- Place the racks carefully back into the corresponding tanks (notice the color indicator).
- Place the upper rack carefully back on the corresponding lower rack (notice the color and the arrow).

**IMPORTANT:**

*Check that the colors of the upper and lower racks correspond with that of the respective tanks:*

<i>Developer</i>	=	<i>red</i>
<i>Intermediate wash</i>	=	<i>black</i>
<i>Fixer: long rack (F1)</i>	=	<i>blue</i>
<i>short rack (F2)</i>	=	<i>blue</i>
<i>Final wash</i>	=	<i>white</i>

*It is recommended that the tanks be filled before the racks are put back in place (as described in 4.2).*

### 8.2.6 Cleaning the intermediate wash rack

- Turn off the NDT S i.
- Remove the machine cover.
- Remove the sprayer cover from the intermediate wash rack (fig. 14).
- Press the latch clip outwards, so the rack can be removed (fig. 15).
- Take the intermediate wash rack by the handles and lift it out of the tank. In the rack there is a water distribution plate that ensures an even water distribution when the films are being sprayed. Be careful that this plate remains in the correct position in the intermediate wash rack (fig. 16 and fig. 17).
- Thoroughly clean the intermediate wash rack with a soft sponge under running water.
- Clean the sprayer cover with FIXCLEAN. Be sure that the sprayer holes are clear (fig. 18).
- Clean and decalcify the washing tray and the intermediate wash tank with FIXCLEAN.
- Place the intermediate wash rack back into the tank.
- Replace the sprayer cover on the intermediate wash rack.
- Replace the machine cover.

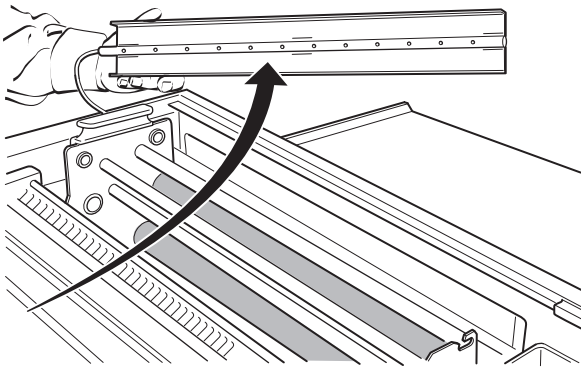


Figure 14

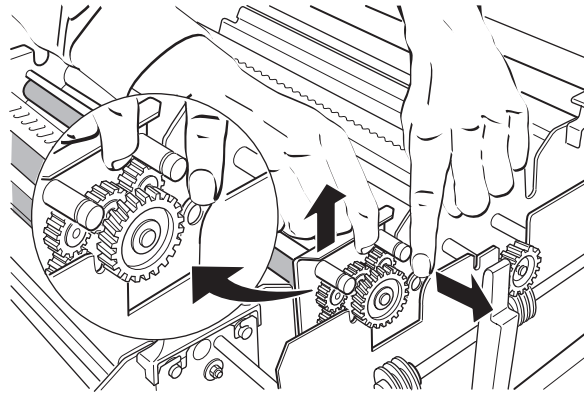


Figure 15

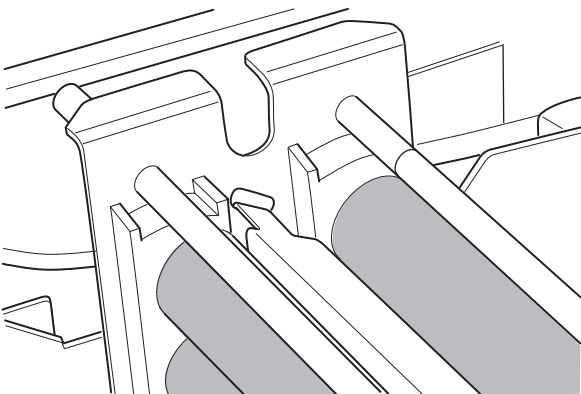


Figure 16

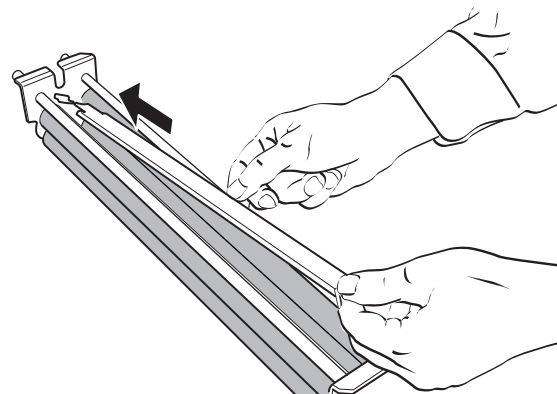


Figure 17

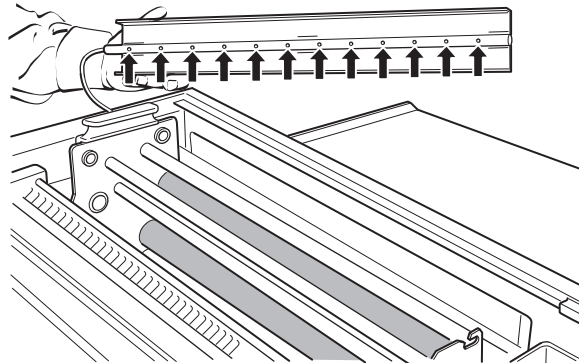


Figure 18

### 8.2.7 Cleaning the distribution rollers

- Switch off the NDT S i.
- The distribution rollers (fig. 19) consist of one unit with three pairs of rollers that can be removed and cleaned together.
- Remove the dryer cover.
- Remove the distribution roller unit along the dryer compartment (fig. 19).
- Clean the rollers with a soft sponge or a lint-free cloth, possibly with an abrasive-free neutral soap.
- Put the distribution rollers and the dryer cover back in place.

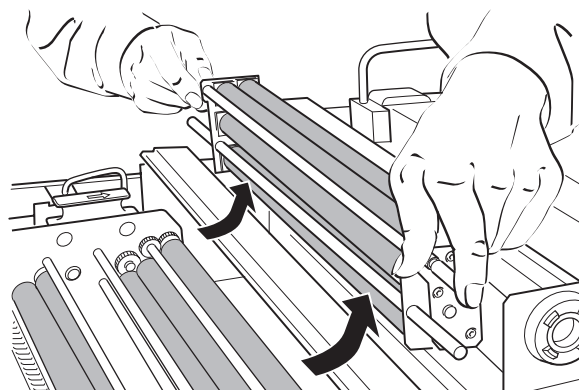


Fig. 19

### 8.2.8 Time periods for cleaning and maintenance

In connection with the maintenance of your developer machine, GE Inspection Technologies provides suitable maintenance contracts. You can obtain more information from your **GE Inspection Technologies representative**.

<i>Period</i>	<i>Maintenance / cleaning</i>
<b>Daily</b>	<i>Before starting to work</i>
	<ul style="list-style-type: none"> <li>• Clean the feed table</li> </ul>
	<ul style="list-style-type: none"> <li>• Clean the upper racks</li> </ul>
	<ul style="list-style-type: none"> <li>• Run several cleaning films through</li> </ul>
	<i>After finishing work</i>
	<ul style="list-style-type: none"> <li>• Turn off the NDT S i. The wash water tank empties automatically (for position of drain tap see 8.2).</li> </ul>
	<ul style="list-style-type: none"> <li>• Leave the machine cover standing open.</li> </ul>
<b>Weekly</b>	<ul style="list-style-type: none"> <li>• Clean the racks and check the delivery rollers of the upper racks.</li> </ul>
	<ul style="list-style-type: none"> <li>• Clean the distribution rollers.</li> </ul>
	<ul style="list-style-type: none"> <li>• Check the operation of the film surface sensor</li> </ul>
<b>Every 2 to 6 months</b>	<ul style="list-style-type: none"> <li>• Clean the device using the appropriate GE Inspection Technologies cleaning chemicals.</li> </ul>
	<ul style="list-style-type: none"> <li>• A <b>GE Inspection Technologies service technician</b> should carry out major maintenance.</li> </ul>

### 8.2.9 Useful tips

*Preparing replenishment liquid (diluting concentrates):*

The correct dilution method is indicated on the package concerned. If you deviate from these instructions, for example, by adding products in the wrong sequence or by insufficient stirring, a precipitate can develop that does not dissolve later and can cause problems in the filters and the racks in the machine.

Remove residues of ready-to-use chemicals from receptacles before preparing new chemicals. They can also cause a similar precipitation. For the preparation of chemicals it is therefore better to use a NDT MIXER.

Chemicals that have been diluted incorrectly must be discarded. Pour them into the corresponding waste tanks for used chemicals.

Cleaning agents can also be dumped in the corresponding waste tanks. For information see the table below:

<i>Cleaning product</i>	<i>Can be dumped in...</i>
DEVCLEAN	Fixer waste tank
FIXCLEAN	Developer waste tank

If necessary, contact a GE Inspection Technologies Service specialist to have your mixer and replenishment system thoroughly cleaned. The above-mentioned products can also be used for this purpose.

### 8.2.10 What about environmental regulations?

As for photo chemicals, there are also special regulations for cleaning products with regard to their disposal and local regulations MUST be followed.

### 8.2.11 Functional check-up

- Inspect film sensor:
  - Are the detection rollers clean?
  - All magnetic rollers must turn easily and evenly to ensure a correct replenishment volume (the rollers can seize up if liquid is spilled on them).
  - To test the operation of the surface sensor, the machine must be in stand-by (dryer ventilators are stopped). With a film strip approx. 35 mm wide, each of the 11 detection rollers is activated. Slide the film back and forth under one of the rollers. The OK signal should disappear and -- FILM -- should appear on the display. Wait until the OK signal reappears and repeat the procedure for the other detection rollers.

## 8.3 MAJOR MAINTENANCE

For a thorough maintenance procedure, GE Inspection Technologies provides an extensive series of formulas via the GE Inspection Technologies Service department in your country.

In consultation with GE Inspection Technologies, a maintenance schedule is worked out that is ideally suited to your specific needs.

## 9. TECHNICAL DATA

The following tables show the standard values (the right to make modifications is reserved):

<i>Film developer machine</i>	<i>Type</i>	<i>Power connections</i>
NDT S i	5320/350	208, 230-240 Volt / 50,60 Hz
<b>Characteristics</b>		
Dimensions	Length (max)	162 cm (including basket 209 cm)
	Width	71 cm
	Height (max)	123 cm
	Footprint	71 x 111 cm
Weight (kg)	Empty	gross: 405 – net: 293
	With tanks full	426
Racks		Upper part / complete
	- developer rack	3.5 / 21.0
	- intermediate wash rack	- / 3
	- fixer 1 rack	3.5 / 19.5
	- fixer 2 rack	3.5 / 14.5
	- water rack	3.5 / 14.5
Electrical connection	Electricity (amp)	16 A
Power supply	Voltage (volt)	208 to 240 V
	Frequency (hertz)	50/60 Hz
	Capacity (watt) (max)	3.300 W (film transport)
Dryer	Number of dryer levels	20
	Default setting	setting 3 for 8 min. cycle
Noise level	Film transport	63 dB
	Stand-by	50 dB
Tank content with racks	Developer	37 l
	Fixer 1	37 l
	Fixer 2	27 l
	Water	27 l

The following data apply for film processing during a standard processing of 8 minutes:

<b>Film</b>			
Process time	Default setting	8 min/82°F	
	Limits	1.5 to 12.5 minutes	
Process speed	Default setting	51 cm/min	
	Limits	32 to 265 cm/min	
Film	Types	NDT and all industrial x-ray films suitable for machine processing	
	Width (max)	43.2 cm	
	Length (min. / max.)	12 cm / 500 cm	
	Smallest format	6 x 12 cm	
	Capacity per hour	6 x 12 cm (6x)	1148 films/hour
		14 x 17 "	78 films/hour
<b>Liquids</b>			
Water	Connection	Permanent connection 3/4 "	
	Standard usage	13 l/m <sup>2</sup>	
	Usage limits	1 - 13 l/m <sup>2</sup>	
	Pressure (min/max)	1-6 bar	
	Temperature (min)	41°F	
	pH value	6.5 to 8	
Chemicals	Aut. devel.	Devel. G 135 + G 135 S (starter) Fixer G 335	
	Standard replenishment	Devel. 0.900 l/m <sup>2</sup> Fixer 1.200 l/m <sup>2</sup>	
	Replenishment limits	Devel/Fix: 0.200 - 1.500 l/m <sup>2</sup>	
	Default setting temp.	Devel/Fix: 82°F	
	Temperature limits	Devel/Fix: 68 - 104°F	
	Warm-up time from 64 to 82°F	22 min	

## 10. ACCESSORIES AND PERIPHERAL EQUIPMENT

The right to make modifications is reserved.

### 10.1 ACCESSORIES

	<b>Ordering code</b>
• Light tight cover	38KTB
• Dark wall panel	39X91
• Water filter with filter cartridge	2G2YV
• Two replenishment tanks of 30 litres with a level sensor	3779N
• Two replenishment tanks of 80 litres with a level sensor	3778L
• Communications cable for NDT Mixer (50 Hz)	CM+8.5280.3030.0

### 10.2 PERIPHERAL EQUIPMENT

• The NDT MIXER (50 Hz)	3U66F
• NDT FEEDER combined with:	3677A
a UNIVERSAL magazine	368AJ
or a FLIPTOP magazine	3679E
• SILVERFIX	38DBK
• Cathode for SILVERFIX	381PZ

