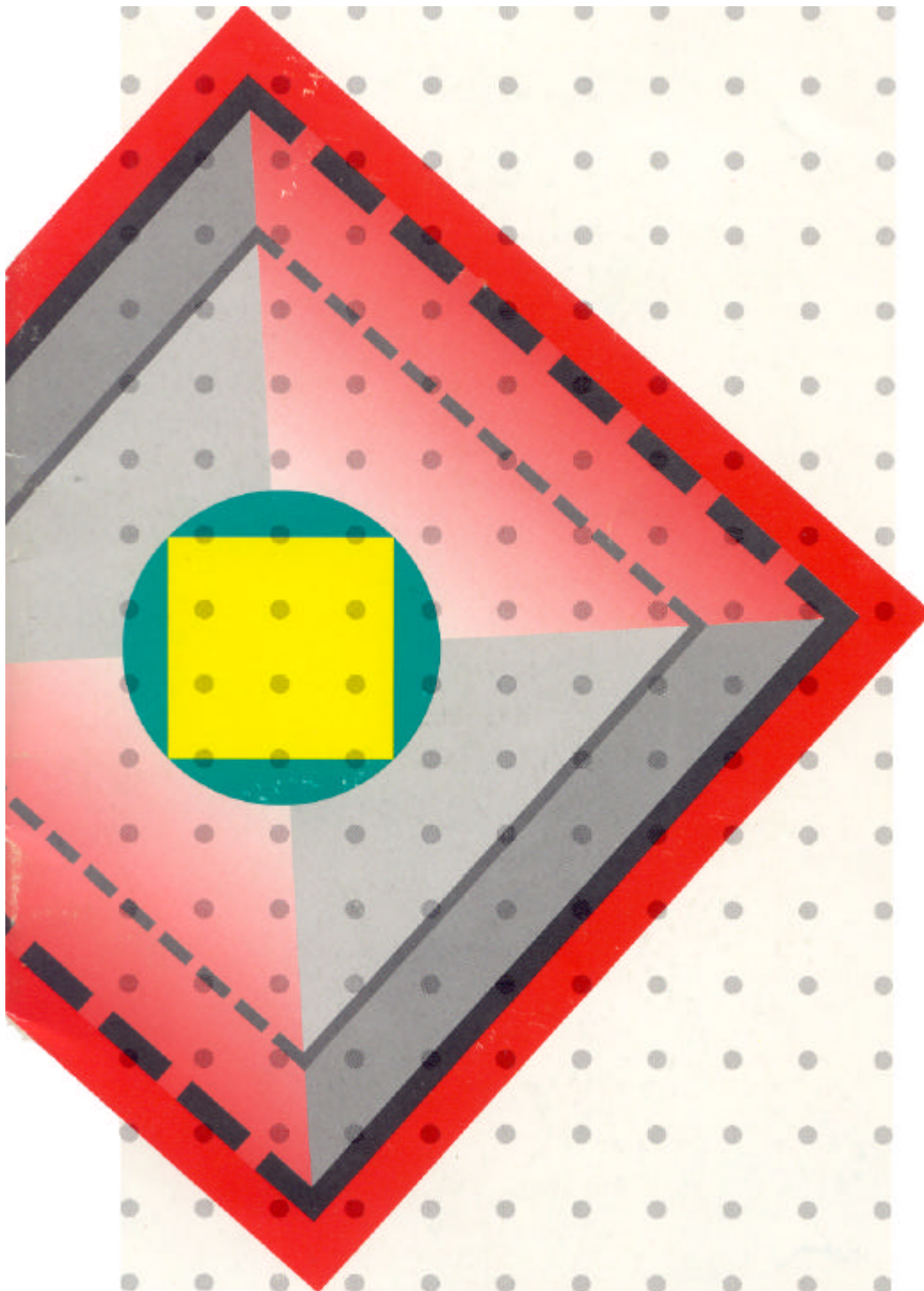




# Advisory guide-line air quality archives





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This report is a part of the Expertiseprogramme Technical Function 1994 of the Government Buildings Agency Netherlands, Ministry of Housing, Spatial Planning and the Environment.

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*Publisher : Government Buildings Agency Netherlands.  
Department Design & Engineering  
The Hague*

*Author : ing. R. Vosteen  
Unit Climate-engineering  
tel. +31 70 3391783*

*Layout : Jan-Heyme Goedkoop  
Amsterdam*

*Production : Romer BV  
Schiedam*

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# 1 Purpose of the advisory guide-line



The purpose of the II Advisory guide-line for air quality of archives" is to achieve a responsible climate with the preservation of archives by means of a performance and quality description of the installations, during design and implementation.

Within the framework of the Delta Plan Culture Preservation criteria are necessary to obtain optimal solutions for the various preservation facilities.

By indicating the real requirements for the archives and the required standard provisions, the implementation of the Delta Plan will be better controllable.

The technical specifications of the advisory guide-line support the achievement of a wide quality of the provisions within the objectives of the Delta Plan:  
a responsible preservation of cultural heritage at a reasonable costs of investment, exploitation and maintenance.



## 2 Summary



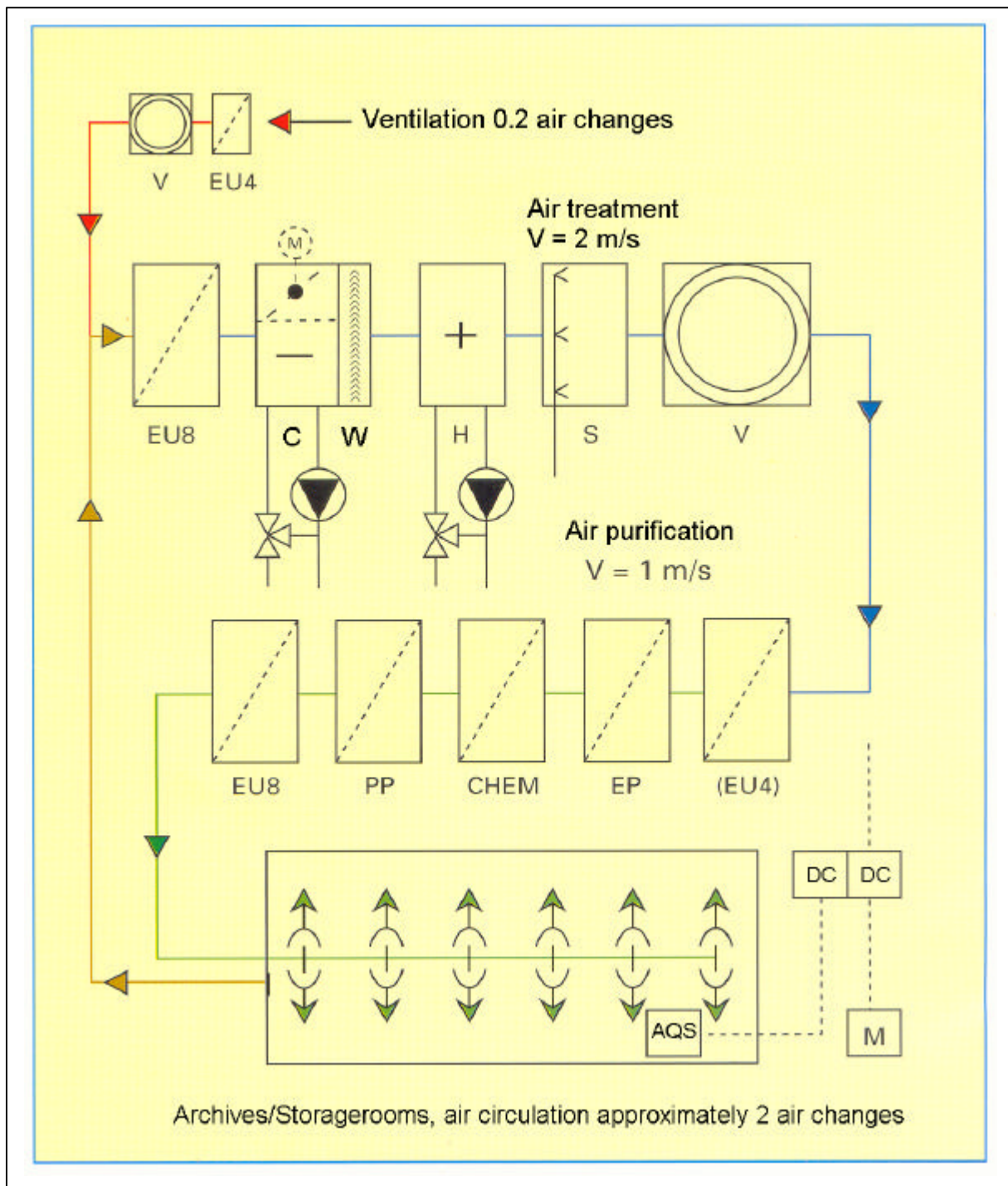
The indicated performance and quality allow a weighting of optimal air conditions for the storage spaces in archives with standard facilities.

Deviant climate requirements and insufficient building or appointment quality of the storage space may require further advice.

The "Advisory guide-line air quality of archives" is, together with the "Advisory guide-line air quality museum depots" and "Air quality exposition spaces", a sequel to the Rgd report "Air quality in storage and exposition spaces", which are referred to for more background information. The mentioned further advisory guidelines with the revised report are to be published at the end of 1994.

For the answering of technical questions specialist advice is available.

# Technical layout air treatment and air purification



EU.. = dust filter quality ..  
 V = ventilator  
 C = cooler  
 W = water eliminator  
 H = heater  
 S = steam humidifier

EP = electronic air filter  
 CHEM = chemical air filter  
 PP = carbon air filter  
 AaS = air quality sensor  
 DC = substation digital control/measurement  
 M = modem



## 3 Performance description

### 3.1 Climate requirements

- 3.1.1 The air quality should benefit a long term conservation of preservation objects.
- 3.1.2 The air quality should be adapted to the material of the preservation objects.
- 3.1.3 The fluctuations of the preservation conditions should be kept within indicated requirements for new buildings quality. For existing buildings and for renovations the fluctuations of the preservation conditions are also determined by the accessible quality of the preservation space and the usage.
- 3.1.4 Paper-preservation material, general storage accommodation:  
 air temperature:  $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ;  
 relative humidity:  $50\% \pm 5\%$ ;  
 ventilation continuously: 0,2 air changes approximately.
- 3.1.5 Maps and charts, in case of a separate storage accommodation:  
 air temperature:  $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ;  
 relative humidity:  $50\% \pm 5\%$ ;  
 ventilation continuously: 0,2 air changes approximately.
- 3.1.6 Parchment-material, in case of a separate storage accommodation:  
 air temperature:  $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ;  
 relative humidity:  $50\% \pm 5\%$ ;  
 ventilation continuously: 0,2 air changes approximately.  
 season adjustment winter:  $16^{\circ}\text{C}$ , 45%;  
 season adjustment summer:  $20^{\circ}\text{C}$ , 55%.
- 3.1.7 Micro-film-material, preservation in a separate cooling cell:  
 air temperature:  $7^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ;  
 relative humidity:  $35\% + 5\%$ , -10%.
- 3.1.8 Black/white photographs and colour photographs in special packing:  
 in case of a separate storage accommodation:  
 air temperature:  $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ;  
 relative humidity:  $40\% \pm 5\%$ ;  
 ventilation continuously: 0,2 air changes approximately.
- 3.1.9 Black/white negatives: as micro-film material;
- 3.1.10 Colour negatives, in case in a refrigerator or freezer:  
 temp.: nominal below  $4^{\circ}\text{C}$ , better below  $0^{\circ}\text{C}$  ( $\pm 3^{\circ}\text{C}$ );  
 relative humidity: below 35% (+5%, -10%).
- 3.1.11 Audio/visual-material: as micro-film material;

- 3.1.12 Machine-readable data, so-called MLG material, in case of a separate storage accommodation:  
air temperature:  $18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ;  
relative humidity:  $40\% \pm 5\%$ ;  
ventilation continuously: 0,2 air changes approximately.

### **3.2 Air-conditioning**

- 3.2.1 The preservation space should be qualitatively suitable, sufficiently air tight and appropriate appointed to be able to maintain the air quality with standard installation facilities.
- 3.2.2 The climate requirements should be maintained according to the standard reference year 1964 of the Bilt and with the extreme exterior conditions of the concerning climate region of respectively -8, -10, -12°C. and 90% RH in winter, and 28°C and 60% RH in summer.
- 3.2.3 The recirculation of air in the room should be approximately 2 times the empty space volume per hour.
- 3.2.4 The recirculation of air in the room should be approximately 2.5 times the empty space volume per hour to obtain sufficient air movement in case movable scaffolding are used. When the lay-out of the airconditioning and the scaffolding is properly implemented the circulation of the air in the room may be limited to 2 times after testing the air distribution.
- 3.2.5 The air movement should be assured at a nominal value of appr. 0:01 m/s in the entire preservation space.
- 3.2.6 The air speed of the fully induced air at the preservation material may be maximum appr. 2.5 m/s.
- 3.2.7 The induction of the air supply system should be at least 2 parts of space air to 1 part of the supply air at a distance of 0.5 m from the supply jetdiffuser.
- 3.2.8 The temperature difference between the supply air and the space air should be limited to  $\pm 6^{\circ}\text{C}$ .
- 3.2.9 The difference between the relative humidity of the supply air and the space air should be limited to  $\pm 15\%$  RH.
- 3.2.10 The dust portion of the supply air should be less than  $75 \text{ mg/m}^3$ .
- 3.2.11 The air change requires to be nominally 0.2 times the empty space volume per hour.
- 3.2.12 A small overpressure of appr. 1 Pa (Pascal) of the storage space should be maintained by means of the ventilation air to avoid infiltration.
- 3.2.13 The air conditions should be registered and monitored continuously.
- 3.2.14 The air condition in the archives should be guaranteed by contractual periodic maintenance.

### **3.3 Air purity**

- 3.3.1 The chemical pollution of the air in the archives should meet the air purity class DELTA 1, extremely pure, with a maximum corrosive value of the air of 40 Å (Ångstrom) per 30 days.

- 3.3.2 The air purity should continuously be maintained by a filter-combination with a removing efficiency of gaseous pollutants of minimally 95% at an average pollution of the ambient air.
- 3.3.3 The air purity should be registered and monitored continuously.
- 3.3.4 The air purity in the archives should be guaranteed by contractual periodic and predicted maintenance.

#### **3.4 Management**

- 3.4.1 The computer for control, measuring and monitoring of the installation should be implemented for a free programming.
- 3.4.2 The installation should be able to be controlled and monitored at a distance.
- 3.4.3 The controlled temperature of the supply air should stay within  $\pm 1^{\circ}\text{C}$  of the required value.
- 3.4.4 The controlled humidity of the supply air should stay within  $\pm 3\%\text{RH}$  of the required value.
- 3.4.5 The reliability of the climate installation should be guaranteed by a contractual periodic and predicted maintenance.



## 4 Quality description

### 4.1 Air-conditioning

- 4.1.1 The air-conditioning should maintain the climate requirements and the air purity in the archives continuously.
- 4.1.2 The air-conditioning unit should be finished internally smooth, good to clean and stand decontamination with the usual disinfectants.
- 4.1.3 The speed of the air to be conditioned may not be higher than 2 m/s in the cross-section of the unit.
- 4.1.4 The design of the mechanical parts should be based on continuous working of at least 100,000 working-hours, f.i. bearings or belt transmissions should be designed with a twofold reliability.
- 4.1.5 The design of parts of the installations should meet the optimal requirements of energy consumption and duration of life and easy attainable for maintenance.
- 4.1.6 The fan of the air system should be speed controlled on pressure and designed for the nominal air supply with the maximum allowed pollution resistance of the filters.
- 4.1.7 The fan of the air system should also be designed for the maximum allowed pollution resistance of the air purifying filters, even when these filters are not directly projected.
- 4.1.8 In case the storage space is provided with or will be provided with movable scaffolding, the air system should be implemented with recirculation of nominal 2.5 times the empty space volume per hour.  
The movable scaffolding should be implemented with an open intervening space of minimal 5 cm and should be free approx. 30 cm from (exterior) walls on behalf of the air circulation.
- 4.1.9 The air-conditioning unit should be implemented double-walled, according to the Holland Heating manufacture or equivalent, and should include:
  - long duration bag filter EU8/9;
  - on pressure speed controlled fan;
  - cooler with drip catcher, and if required a controllable by-pass, for dehumidification at ca. 4°C and for the cooling of the sensible heat at ca. 8°C average chilled water temperature;
  - heater;
  - steam humidifier, capacity adapted, adjustable and modulated controllable, (alternative ultrasonic), or separately in the air supply duct;
  - air purification filter case according to the specification and implementation of the Delta Plan.

- 4.1.10 In case one air-conditioning and air purification unit is used for several archive spaces, a separate temperature controller should be applied for these spaces when load differences occur.
- 4.1.11 Ventilation with outdoor air should be supplied by a separate air system at the inlet side of the air-conditioning. It should consist of a exterior ventilator, a vapour trap externally insulated air duct, a coarse filter EU4 and a on pressure speed regulated fan with an air capacity up to 0.2-times the empty space volume per hour.
- 4.1.12 The air ducts should be designed according to the LUKA-norm class B, with an increased air tightness for air ducts outside the storage space according to class C. The air ducts outside the storage space should be externally insulated.
- 4.1.13 The supply and return airduct should be provided with motorcontrolled fire dampers with spring backfly, connected to the operation of the installation with fire alarming. The fire dampers should preferably be located in the engine room.
- 4.1.14 The air supply to the archives should be distributed by well-located jet diffusers, Aerotherm, type SLO. The airstream should preferably be directed from the midway over the scaffolding towards the walls. The air return should be at a central location.

## **4.2 Air purification**

- 4.2.1 The air purification should be provided with a filter combination; Purafil/Twin Holland manufacture, according to the specification and design as developed for the Delta Plan, or equivalent, consisting of:
  - a. pre-filter PP30, class EU4;
  - b. electro-potential filter, manufacturer Futura, with 24V supply, class EU8;
  - c. chemisorbent filter Purafil 11;
  - d. puracarb filter Purafil PP1505;
  - e. end-filter JFL90, class EU8/9.
- 4.2.2 The speed of the air to be purified in the cross-section of the filter may not be higher than 1 m/s.
- 4.2.3 The filter case, when applied as separate filter unit, should be designed according to the specification as developed for the Delta Plan, of Purafil/Twin Holland manufacture or equivalent.
- 4.2.4 The filter case, incorporated as part of the air-conditioning unit, should be designed according to the specification as developed for the Delta Plan, of Purafil/Twin Holland manufacture or equivalent.

## **4.3 Control**

- 4.3.1 The control should be implemented as DDC technology.
- 4.3.2 The control should be done by programming with an open program structure and communication according to Priva manufacture or compatible.
- 4.3.3 The control algorithms of the computer programs should be tuned to the control principles of the installation and the required control accuracy.

- 4.3.4 The installation management system should consist of independent operating sub-stations with a modem connection for remote control and monitoring by means of a telephone line and a local control panel.
- 4.3.5 The controllers and parts should have a characteristic and accuracy, that allows to stay within the required control values of the installation.
- 4.3.6 The selection of the capacity of the controllers and parts should optimally utilize the required working area.
- 4.3.7 The temperature sensors should have an accuracy of minimal  $\pm 0,5^{\circ}\text{C}$ , a reproducibility of minimal  $0,1^{\circ}\text{C}$  and a drift of maximal  $0,1^{\circ}\text{C}$  per year, according the Rotronic manufacture or equivalent.
- 4.3.8 The relative humidity sensors should have an accuracy of minimal  $\pm 2\%\text{RH}$ , a reproducibility of minimal  $0,6\%\text{RH}$  and a drift of maximal  $1\%\text{RH}$  per year, according the Rotronic manufacture or equivalent.
- 4.3.9 Each airhandling should be controlled with the delta control software ,module airhandling, Priva DRM/LB;  
The possible central pre-airhandling should be controlled with the delta control software module,Priva DRU/LVB;  
The delta control software modules are to be configured for the specific installation situation.

#### **4.4 Air quality measurement**

- 4.4.1 The air quality sensor should be of type OnGuard of Purafil/Twin Holland manufacture, of adjusted design as developed for the Delta Plan or equivalent.
- 4.4.2 The supply voltage for the air quality measurement should be 24V with a maximum voltage loss of 5%.
- 4.4.3 The data (communication) cabling should be carried out as  $2 \times 2 \times 0,8\text{mm}^2$  twisted pair with a fail safe ring connection.
- 4.4.4 A computer program with historic saving of registrations should be installed for the monitoring and reading of the substation, at which the air quality sensor is connected. This computer program within the installation management system should be according to the Priva manufacture or equivalent and with an identical protocol.
- 4.4.5 The air quality measurement should be monitored locally and remotely with a modem connection by a telephone line.
- 4.4.6 System components to be applied:  
DDC mounting case inclusive mounting and cabling of:
  - substation Priva Compri 25, type 20;
  - supply voltage 24 V;
  - modem discovery type 2400 C, incl. cables;
  - delta communication software program monitoring air quality, Priva DCP/BLK;
  - supply voltage 220V, by a third party, if possible on no break emergency supply;
  - telephone connection data line, by a third party, by own telephone exchange;
 Air quality sensor type INS 2000, intelligent network station, Purafil/Twin-Holland;

Always one required for communication with the other sub-stations to a maximum of 30 satellites.

Air quality sensor type RSM 2000, remote sensor modules, Purafil/Twin-Holland, as satellites.

Always one required for each airfilter or one per large archive if more archives are combined, including the network station INS 2000.

- data cabling;
- Supply voltage cab/ing;
- commisioning;

Auditing and control unit of the archive service consists of:

- PC Compaq 486-25sxl240;
- colour monitor, Compaq Super VGA, type 1024, 14";
- PC software program Priva Controller N1 minimum;
- printer HP 560 C colour and the necessary accessories.

#### **4.5 Commissioning**

- 4.5.1 With the delivery and commissioning the protocols of measuring, tuning and adjusting of the installation functions are to be approved and laid down.
- 4.5.2 A trend registration of one week with an analysis should guarantee the proper operation of the installation.
- 4.5.3 For the commissioning of the air purification and the delivery of the air purification filters the filter manufacturer should receive a direct commission and form a protocol, in which the predicted maintenance is indicated.

#### **4.6 Auditing and maintenance**

- 4.6.1 A warranty term of 12 months should apply for the work.
- 4.6.2 During the guarantee term the installation engineer should make a trend registration of the most important parameters twice during a week and an analysis of the operation to lay down the proper operation of the installation.  
The registration shou/d be made during a representative summer and winter operating situation or period of transition.
- 4.6.3 The maintenance should be delegated to the maintenance installation engineer after delivery and commissioning.
- 4.6.4 The maintenance and inspection of the air purification should be delegated separately to the filter supplier according to a maintenance specification.





## 5 Consultancy

The engineering of the facilities in the archives takes place within the design team of the related directorate, during the various stages of the developments of the project.

It is important that the technical and financial consequences of the necessary facilities are already indicated in the pre-phase of the project with the framing of the requirements program.

In case the requirements program, that is laid down per project, deviates from the standard requirements, and standard requirements according to the advisory guide-line cannot be fulfilled, further consultation will be held with the central supervision group for the realization of the Delta Plan Culture Preservation.

In this are represented the Ministry of WVC, the user, the Central Directorate Archive Service, the Central Laboratory and the Government Building Agency.

In case the expected design qualities of the new building or the improvement of existing building leads to deviations of the standard requirements or standard facilities, this consultation will also be held.

For further consultation one can apply to:

Rgd Program coordinator Delta Plan projects,

Program/policy:

Directorate Project management

Visiting address:

post address:

A.J Guyt, tel. +31 703391783

Rijnstraat 8,

2515 XP The Hague

P.O. Box 20952,

2500 EZ The Hague

For specialist questions or remarks about the technical design of facilities for archives one can apply to:

Visiting address:

post address:

Department Design & Engineering

Kon. Julianaplein 2

2595 AA The Hague

tel. +31703391783

P.O. Box 20952,

2500 EZ The Hague

fax. +31 703395031

For the speciality:		
General/advisory guide-line:	ing. R. Vosteen	+31 70 3391783
Building physics:	ir. A. Zeegers	+31 70 3391661
Building engineering:	J. Janssen	+31 70 3391680
Construction:	ir. C. van Weeren	+31 70 3391714
Electrical engineering:	F.J. van der Hoek	+31 70 3391753
Air-conditioning engineering:	ir. R.W. Bakker	+31 70 4461275
Logisticsflay-out:	ir. R.M.I.F. van Roosmalen	+31 70 3391696
Control engineering:	J.M. van der Valk	+31 70 3391755
Transport engineering:	M. Dijkhuizen	+31 70 3391770
Wall-/floor finishing:	A. de Grip	+31 70 3391723

Your comment and supplement on the advisory guide-/ine are welcome and may be included in a next version.



## 6 References

Overview of literature of importance about the air quality in archives within the framework of the Delta Plan Culture Preservation.

### 6.1 Policy

- "Deltaplan Cultuurbehoud in Nederland"; WVC, 1990/91, preface by minister H. d' Ancona.
  - Policy intention and inventory making.
- "Vechten tegen verval; de uitvoering van het Deltaplan voor het Cultuurbehoud"; WVC, 1991 publication Sdu.
  - Note 2e Chamber, preservation arrearage, plan of investments.

### 6.2 General

- "Eindrapport van de Commissie Regeling Archiefruimten"; Ned. Arch. Blad, publication 1982, brede commissie.
  - Extreme detailed legislation, same issues do not apply any more
- "Ruimten bestemd voor het bewaren van archieven"; Archiefbeheer, august 1989-may 1990, A.J.M. den Teuling;
  - Part of the subject "material caretaking", detailed and actual information about all aspects of archive management;
  - Archive storage spaces covers the adjusted version of the "Final report 1982".
- "Voorschriften archiefruimten" LOPAI-1991; Publication of the joint provincial archive inspections in The Netherlands, ed.P.J.Margry,
  - Brief version of regulations of "Ruimten bestemd voor het bewaren van archieven" and of articles "Archiefbeheer" with explanation.
- "Passieve conservering klimaat en licht"; Centr. Lab. v. OVKW, 1992 2e revised publication., B.A.H.G. Jütte.
  - Explanation of climate, illumination, measurement, requirements, measures.

### 6.3 Project Delta Plan Culture Preservation

- "Eindrapportage pilotprojekt luchtzuivering"; Rgd/DO&T, april 1992, R. Vosteen, R.W. Bakker.
  - Investigation of methods for air purification in the General Public Archive Office, The Hague.
  - Plan, measurement results and recommendations.
- "Onderzoek naar het rendement van luchtfilters in het Algemeen Rijksarchief te 's-Gravenhage"; TNO B-91-11 18,3 dec. 1991, A.W. Hoogeveen, J.F.van der Wal.
  - Measurement results filter experiments pilot project.
- "Ventilatie van archiefruimten van het Rijksarchief te Den Haag"; TNO B-92-0719, 5 aug.1992, W.F. de Gids, A.D. Lemaire, L.L.M. van Schijndel.
  - Model research air flow and conservation with compactus storage

- "Preventieve maatregelen tot behoud van archivaria en boeken";  
TNO P89/075a, 12 april 1990, A.W. Lanting.
    - Air pollution and measures, an overview.
  - "Luchtverontreiniging en de aantasting van papier";  
WVC publication, october 1990/ reprint of TNO P89/075a.
  - "Luchtverontreiniging in musea en archieven";  
TNO P 87/085/4 january 1988/ J.F. van der Wal, A.W. Lanting.
    - measurement air quality in 6 projects, summer and winter situation.
- "Luchtkwaliteit in bewaar- en expositieruimten";  
Rgd/DO&T, concept version jury 1992, R. Vosteen.  
Continuation pilot project, version 1994 is in preparation
- overview technical state of affairs, information air quality measurement and investments.