



REPORT CONCERNS ORIENTATING INVESTIGATION ON THE BEHAVIOUR UNDER FIRE  
CONDITIONS (CHIP PAN FIRE) OF A FILTER VENTILATED CEILING CONSISTING OF MIVIKO  
FILTER CASSETTES (MAKE: STAINLESS-STEEL)

Reportno.: B-84-178(E)

Orderno. : 00.65.6.0084/017

# IBBC

Instituut TNO voor Bouwmaterialen en Bouwconstructies

Bezoekadres: Lange Kleiweg 5, Rijswijk (ZH)

postbus 49 2600 AA Delft

tel. 015-138222 Telex 38270 IBBC NL

**centrum voor brandveiligheid**

# INSTITUTE TNO FOR BUILDING MATERIALS AND BUILDING STRUCTURES

NETHERLANDS ORGANIZATION FOR APPLIED SCIENTIFIC RESEARCH

LANGE KLEIWEG 5  
COMPLEX PLASPOELPOLDER  
RIJSWIJK (Z-H)



P.O. BOX 49, DELFT, THE NETHERLANDS  
TEL. 015 - 138222 TELEX 33567

## REPORT

Nr. B-84-178(E)

Orderno.: 00.65.6.0084/017

Date : April 1984

**Re:** AN ORIENTATING INVESTIGATION ON THE BEHAVIOUR UNDER FIRE CONDITIONS (CHIP PAN FIRE) OF A FILTER VENTILATED CEILING CONSISTING OF MIVIKO FILTER CASSETTES (MAKE: STAINLESS-STEEL)

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Author: J. Dekker

Miviko B.V.

**To:** Leigraafseweg 2  
6983 BP DOESBURG

This report has been compiled in April 1984.  
If it has to be used after a period of time, it is advisable to contact the Technical Centre for Fire Prevention TNO, to check whether the usefulness of the contents has remained unaltered.

This report contains 6 pages + 1 drawing.

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Subject : Ceiling consisting of Miviko filter cassettes  
(make: stainless-steel).

Investigated for : Behaviour under fire.

Sponsor : Miviko B.V.  
Leigraafseweg 2  
6983 BP DOESBURG

Date of experiment : February 20th, 1984.

Purpose and aim of the  
investigation : False ceilings such as under investigation are  
used in kitchens of hotels, hospitals, nursing  
homes, barracks, etc., among others.  
This suspended false ceiling is built out of  
filter cassettes of stainless steel, resting  
upon aluminium ceiling sections. The  
construction of the cassette ceilings is such  
that exhaust air extraction occurs over the  
whole surface area through slots in the  
cassettes.  
According to the supplier, the cassettes are so  
constructed that they also act as grease  
collecting filters. In this way, it should be  
possible to avoid grease and other such  
deposits from accumulating on the bottom  
surface of the floor above, from which it is  
suspended, as well as the connecting air  
transmission ducts, ventilators, etc. In case  
of a fire under the ceiling, (such as chip pan  
fire), the spread of fire via the enclosed gap  
above the ceiling could be avoided due to this.  
In order to obtain more information on this  
question, an orientating investigation is  
carried out, where a practical situation of  
chip pan fire under a Miviko ceiling under air  
suction is simulated.

The investigated structure : In an industrial space in Almere, a test ceiling was built, suspended from the soffit of the floor above, made up of flat steel panels. The surface area of this false ceiling and adjacent floor were about 3m x 3 m. The whole structure rested upon 4 steel columns, built up with corrugated steel plate. The height of the gap between the false ceiling and the floor above was about 0.3 m. The false ceiling was 3.05 m above the lower floor. The sides of the 0.3 m void were enclosed with steel plating. Over a height of 1.16 m below the ceiling, aluminium plate was provided against the sides of the column.

On the top of the floor above the false ceiling, a layer of rock wool provided, so that heat loss from the 0.3 m void via this floor was limited as much as possible.

In the centre of this topping, a 400 mm diameter air extraction duct was constructed. A ventilator was fitted to this duct. The false ceiling consisted of 36 cassettes, made stainless-steel 50 x 48 x 7 cm. The cassettes came from an existing false ceiling in a kitchen. The false ceiling was in use for several years. The cassettes were therefore deposited with a thin layer of grease, especially around the air suction slots. The cassettes were placed upon aluminium ceiling rails that were suspended from the top floor at centre to centre distances of 0.5 m by means of ceiling hangers. Four ceiling hangers were used for each ceiling rail. Along the sides of the floor, the cassettes were placed upon an aluminium frieze.

- For further details, see appended drawing no. 1 -.

Method of testing

: In the centre of the room under the ceiling, a deep frying pan measuring 0.5 x 0.36 x 0.1 m was placed. The distance between the bottom of the pan to the soffit of the false ceiling was  $3.05 - 0.8 = 2.25$  m. The frying pan was than filled with 9 litres of deep frying fat, so that the pan was filled with fat up to a height of 0.05 m. The air suction through each cassette was set at approx.  $65 \text{ m}^3/\text{hr}$ , which is according to the sponsor an average value for a kitchen exhaustion. The total air suction of the ceiling amounted to approx.  $36 \times 65 = 2500 \text{ m}^3/\text{hr}$ . During the test, temperatures were measured by means of 11 thermocouples at different locations. The thermocouples (tk) were provided as follows:

- tk 1,2,3 and 4 in the 0.3 high void at a distance of 0.1 m under the soffit of the floor.
- tk 5 in the air duct, at approximately 2 m distance from the air duct opening in the floor.
- tk 6 at 0.1 m distance below the false ceiling and directly above the centre of the deep frying pan.
- tk 7 at a distance of 0.5 m under the ceiling and directly above the centre of the deep frying pan.
- tk 8 and 9 in an individual suction slot of a cassette place above the middle of the deep frying pan.
- tk 10 in the centre of the air duct at the junction with the floor.
- tk 11 in the deep frying pan.

Finally, visual observations were made on the behaviour of the false ceiling and in the 0.3 m void between the top floor and false ceiling. The fat was heated by means of a propane burner until self-ignition of the frying fat occurred.

#### Observations

: At 0 minutes, self-ignition of the frying fat occurred at a temperature of 372°C in the fat. After 1 minute, the flames were about 1.2 m high. The underpressure in the 0.3 m gap was observed to be 4 Pa. During the whole duration of the test, this suction pressure remained fairly constant at 4 - 5 Pa.

After 2 minutes, the flames had reached a height of 1 m above the deep frying pan. The 0.3 void became gradually filled with smoke.

After 2.5 minutes, the length of the flames increased. The distance between the top of the flames to the underside of the false ceiling was about 0.5 m.

After 5 minutes, the distance became about 0.2 m. The 0.3 m gap was completely filled with smoke.

After 7 minutes the void was still filled with smoke.

After 10 minutes, the distance from the top of the flames to the underside of the false ceiling was about 0.5 m. A temperature of 480°C was measured by tk 11 at that moment.

After 15 minutes, a temperature of 130°C was measured on the outside of the air duct.

After 17 minutes, the length of the flames began to reduce. The distance of the top of the flames from the false ceiling became about 1 m.

After 18 minutes, a temperature of about 700°C was measured by tk 11.

After 20.5 minutes, it was decided to end the test in agreement with the sponsor. This decision was influenced by the fact that the temperature both below and above the false ceiling began to fall.

During the whole duration of the heating, no flames were observed in the 0.3 m ceiling void. The highest temperature observed in this void was 127°C, while under the false ceiling it was 205°C. The deformations in the ceiling were hardly noticeable.

The measured temperatures are summarized in Table I.

Table I

Duration of heating in minutes	Measured temperatures in °C									
	under the false ceiling		in the 0.3 m gap				in the air duct		in an individual suction slot of a cassette	
	tk 6	tk 7	tk 1	tk 2	tk 3	tk 4	tk 5	tk 10	tk 8	tk 9
0	15	15	15	15	15	15	15	15	15	15
5	200	180	120	110	115	125	110	140	110	-
10	140	125	125	100	105	127	65	125	-	140
15	140	150	98	80	88	110	-	110	105	90
18	140	115	95	75	85	100	-	105	-	-

Summary and conclusions

: An orientating investigation has been carried out on the behaviour of a filter ventilated ceiling, consisting of Miviko filter cassettes (make: stainless-steel) when subjected to a fire (chip pan fire).

The ceiling, with measurements of 3 m x 3 m and a suspended height of 0.3 m was provided under a floor made of non combustibile materials. The suction in the ceiling was set at 65 m<sup>3</sup>/hr. per cassette.

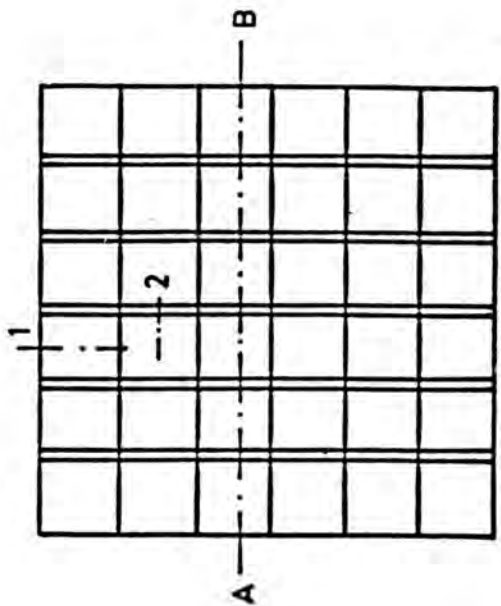
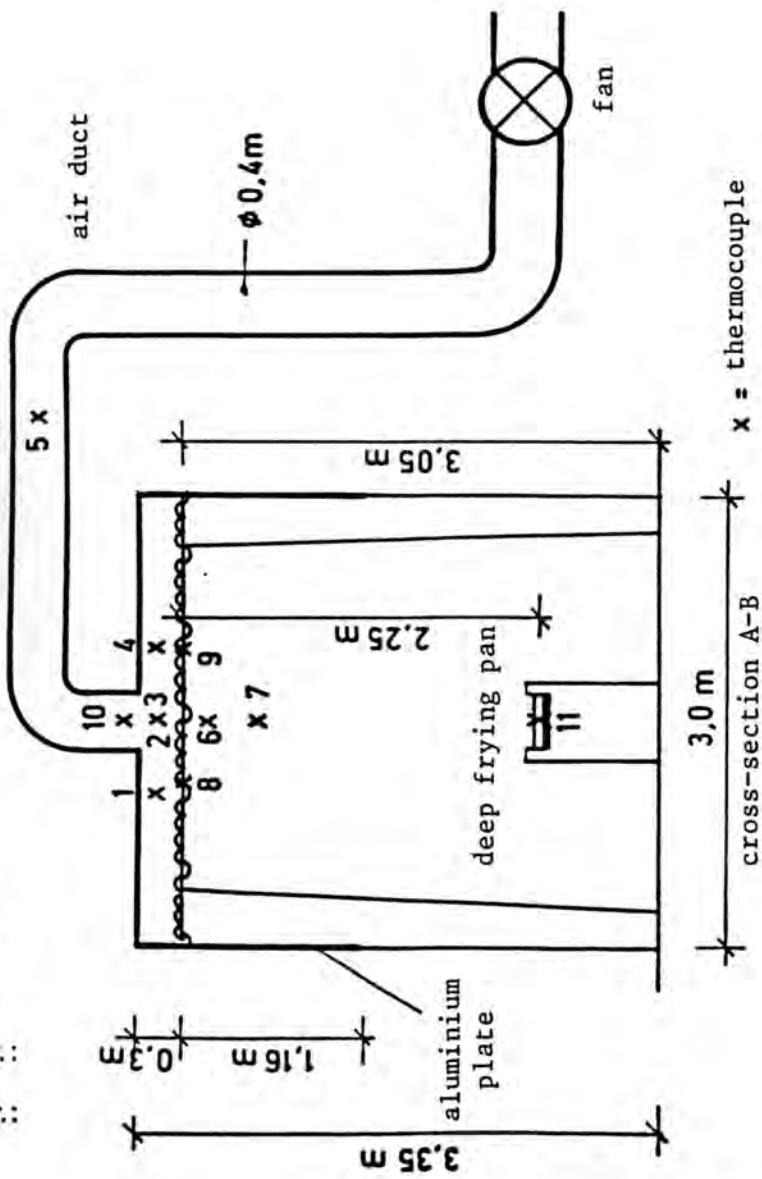
Fat in a deep frying pan, placed 2.25 m below the ceiling, was heated up to self ignition. The soffit of the false ceiling was exposed to heat for a duration of 20.5 minutes. Under the circumstances in the test - false ceiling suspended under a floor of non combustibile material and with a distance between the false ceiling and deep frying pan of 2.25 m - no collapse of the ceiling or spread of the fire in the 0.3 m gap was observed.

Technical Centre for Fire Prevention TNO,

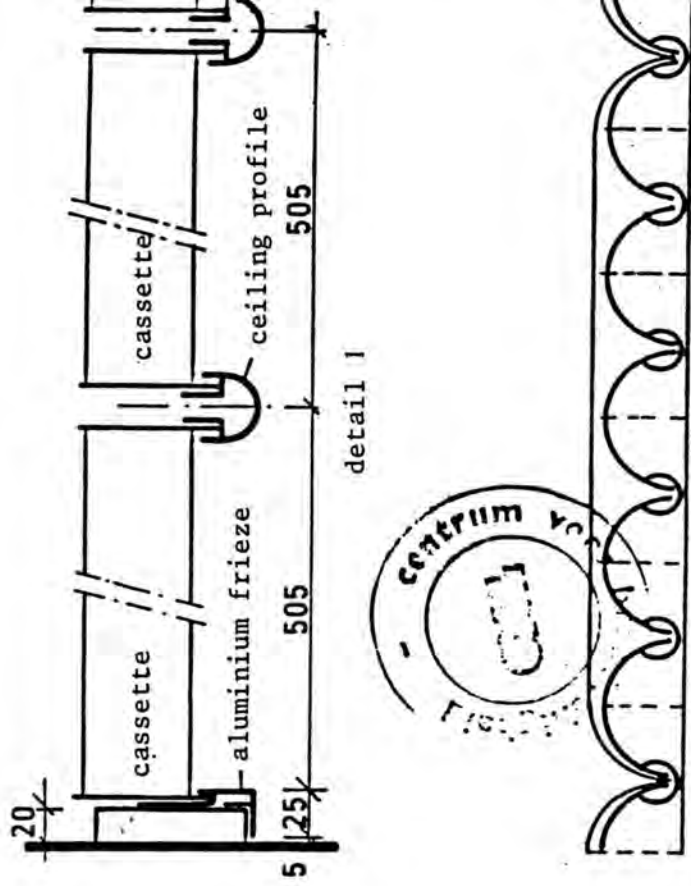
  
J. Dekker

  
A.F.R. Harms





underside view of false ceiling



detail 1



cassette

detail 2

TEST SET UP FOR FILTER VENTILATED CEILING

DRAWING NO. 1