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OVERVIEW OF PRACTICE IN VARIOUS COUNTRIES

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The ongoing standardisation in Europe within the ventilation field has been intensified during the last decade which is presented in a parallel paper. A trend from the standardisation will be that national standard specifications like the US quality requirements developed by SMACNA and ASHRAE, the British specifications like DW/142 published by HVCA and others will be replaced by European Norms.

Another parallel presentation shows how ductwork for ventilation has developed towards tighter and more reliable installations since the 1950's especially for round ducts but also for rectangular ductwork.

Sweden has, since 1950, a unique system for expressing quality demands for building and installation works in the AMA-system. AMA stands for "Allmän Material och Arbetsbeskrivning" - General Specification for of Material and Workmanship - which is used by practically all experts for drawing up building and installation specifications. AMA is split up in four different, slightly overlapping, parts: Land AMA (for Civil Engineering Projects), House AMA, El AMA (Electrical Works), and VVS AMA (HVAC). Kyl AMA (for Refrigeration) is a separately published part of the latter.

The author of this paper has been responsible for HVAC AMA since 1976 and is now working together with a group of specialists with the updating of VVS AMA 83 to VVS AMA 98.

AMA is published by The Swedish Building Centre - AB Svensk Byggtjänst - is owned by companies and institutions from all parts of organisations from the building line of business - contractors, private and governmental building owners, architects and engineers, and manufacturers.

In AMA quality requirements are specified according to a "eighty/twenty role" (that is corresponding to what is normally a good standard of practise in 80% of all cases). There are a few main rules that governs the AMA specified quality requirements:

- they shall be expressed in measurable units and not expressed only verbally (e.g. the air tightness of a duct is not expressed as "it shall be tight" but "it must not leak more than ..".
- testing of the requirement shall normally be part of the contract (i.e. the cost for testing is included in the offered price, the testing is normally done by the contractor but in the presence of the customer. Should the test show that the requirements are not fulfilled, the contractor has to make necessary supplementary works and then make new tests on his own cost until his work is found satisfactory)

- the method to control the requirements shall be specified and have a known and low total measurement error (including the errors for method, instrument and reading - e.g. for adjusting air flows in a system, the specified air flow for each supply or extract register is allowed to differ ± 15% inc. measurement error)
- the results of measurements, adjusting, etc., are to be delivered to the customer on specified formats as included in the AMA books
- the tenderers (one of which is going to be the successful contractor) shall be able compute the costs of all requirements (i.e. they have to be clearly stated and, as above, specified in measurable units).

Examples of AMA requirements regarding ductwork are:

- tightness requirements according to tightness class A, B, and C. In the new VVS AMA 98 class D will be included. Today class A is accepted for visible ducts ”within the room served by the ventilation system”, B for rectangular ductwork and small round systems, and C for large round systems (> 50 m² duct perimeter area).
- tightness testing shall be included and done for sample tests, each of approx. 25 m² duct perimeter area, for 10% of all round duct systems, 20% of all rectangular duct systems, and 100% of all ”tailor-made” or otherwise manufactured plenum or distribution boxes etc. Should the tests show that the requirements are not fulfilled, the same portion of the total systems are to be additionally tested, and if also these new tests are unsuccessful, all ducts are to be tested - all on the expense of the contractor.
- hangers for ductwork are to be of the same fire class as the duct itself and has also to withstand an extra force of 1 kN corresponding to the weight of a person sitting on or hanging from the duct (the reason for this is that thoughtless people have used the duct as a convenient but dangerous scaffold when e.g. changing light fittings).
- corrosion-resistance is specified as corresponding to ”environment classes”, M0 through M4B ranging from ”Indoors in heated rooms” with no corrosion at all to ”Heavy polluted industrial areas such as some chemical industries as pulp mills, refineries or fertilizer industries. The normally used galvanised steel sheet (Z 275) or other materials like aluminium are to be protected by additional corrosion protection layers as specified for the different environment classes.
- marking of ducts and duct components is to be made according to the technical documentation of the installation and should show e.g. type of air (supply, extract, overflow, or exhaust), flow direction, component number (e.g. for fire dampers and air flow measurement devices).
- air flow adjustment method, proportional (the more commonly used) or pre-adjustment (requiring an as-built pressure drop calculation) methods.
- duct covers to prevent dust to enter the ductwork before it is taken into operation. These covers are used from the manufacturer, during transport and are not removed until the next piece of ductwork is connected. All the time the end parts of the system is locked. Permanent ventilation systems should not, for the same reason - not to become dirty on the inside, be used during the construction period as a provisional way to heat and ventilate the building. This latter stipulation is part of the AMA administrative requirements.

The method to use the AMA is quite simple both for the designer and for the contractor. The quality requirements (proposed by the group of expert investigators, discussed within a reference group and decided after being sent out to a large number of bodies to which the proposed measures are referred for consideration) are specified in detail being identified by a unique code (according to the BSAB-system) and a heading.

The author of the specification, normally the designer, refers to the requirement just by using the code and the heading. This means, according to the rules of the game, that this part of the AMA text is considered to be part of the specification. The bidders and the contractors read this relevant text in AMA (and probably know it without reading once they get used to it) instead of in the specification. The author of the specification adds the quantity (how much, how many, how long, etc.) to make it possible to calculate for the cost accountant and make those alterations, deletions and additions he might find appropriate for his unique installation. These changes and completions then ”take over” these parts in AMA.

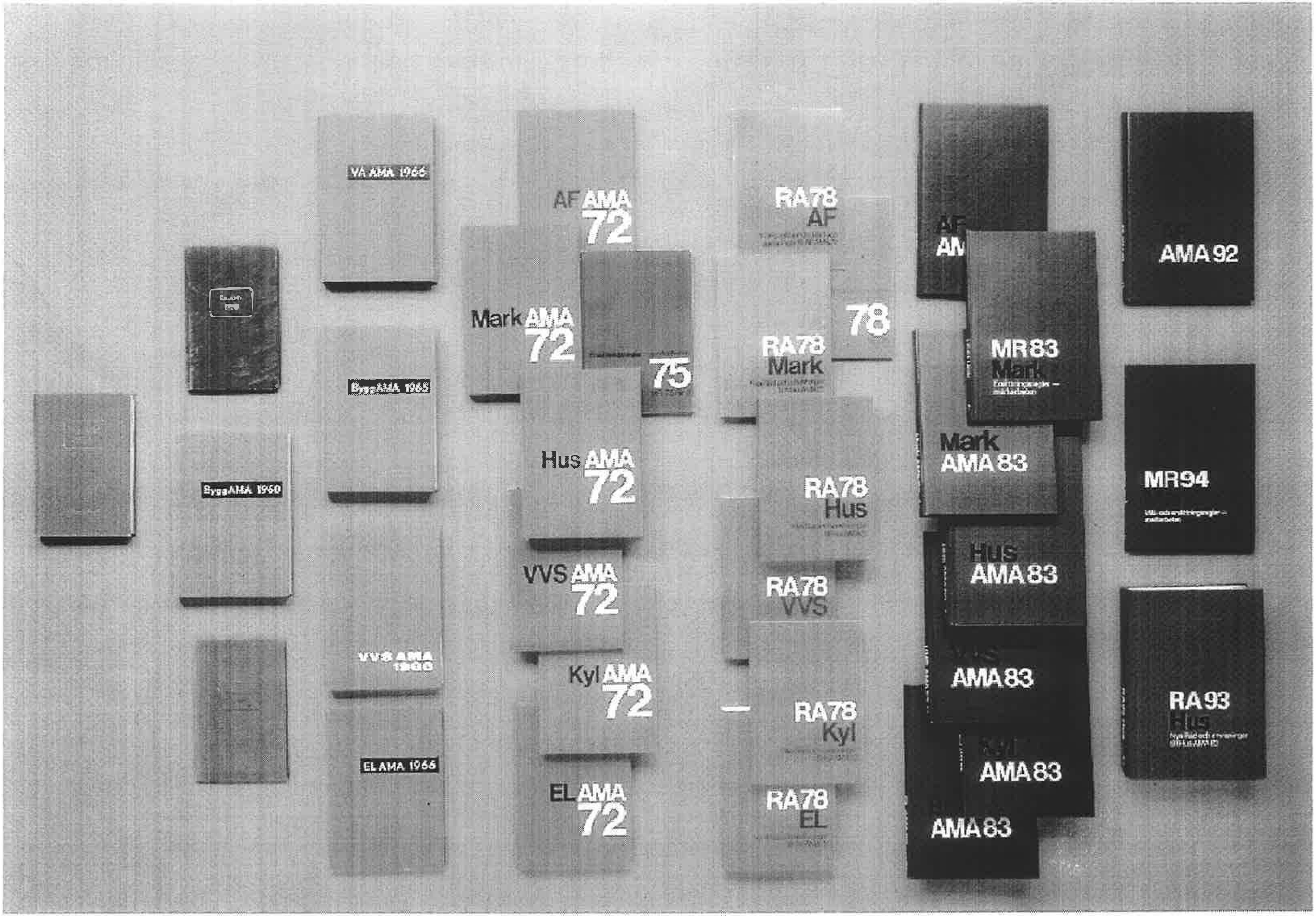
How has AMA influenced the quality of ductwork in Sweden?

Comparing the quality of ductwork between Sweden and most other countries shows a higher standard and tighter systems in Sweden.

One reason for this is most certainly that we very early started to identify the need for tight systems (air shall be delivered to the correct room and with the right flow and not be allowed to leak out of the system along the way) and specified the requirements for maximum leakage for different applications. These requirements were also coupled to control measures (demands without control does not always work) that were accepted by all parts.

With increasing possibilities from better and better products (as presented in a parallel paper) these requirements have been raised with the time. The improved quality from the manufactured components shall be used to improve the installation, not used to make it more and more easy for the contractor to fulfil the demands.

Calculating the cost for improved systems (e.g. tightness class C instead of A) shall be made not only on the first investment cost but on a life cycle cost (LCC) basis. The duct system is there to serve the building for at least the next twenty years and during that time a lot of air could be saved by using a tighter system. This will reduce not only the costs but probably also result in less noise and indoor pollution from the system and make it easier to guarantee the indoor air quality by delivering the right airflow to dilute and transport away emissions from indoor pollutants.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