MODULE E D4S RULES OF THUMB

1> SELECTION OF LOW-IMPACT MATERIALS_

a> Cleaner materials

1_ Do not use materials or additives which are prohibited due to their toxicity. These include PCBs (polychlorinated biphenyls), PCTs (polychlorinated terphenyls), lead (in PVC, electronics, dyes and batteries), cadmium (in dyes and batteries) and mercury (in thermometers, switches, fluorescent tubes).

2_ Avoid materials and additives that deplete the ozone layer such as chlorine, fluorine, bromine, methyl bromide, halons and aerosols, foams, refrigerants and solvents that contain CFCs.

3_ Avoid the use of summer smog-causing hydrocarbons.

4_ Find alternatives for surface treatment techniques such as hot-dip galvanization, electrolytic zinc plating and electrolytic chromium plating.

5_ Find alternatives for non-ferrous metals such as copper, zinc, brass, chromium and nickel because of the harmful emissions that occur during their production.

b> Renewable materials

6_ Find alternatives for exhaustible materials.

c> Lower energy content materials

7_ Avoid energy-intensive materials such as aluminum in products with a short lifetime.

8_ Avoid raw materials produced from intensive agriculture.

d> Recycled materials

9_ Use recycled materials wherever possible, to increase the market demand for recycled materials.

10_ Use secondary metals such as secondary aluminum and copper instead of their virgin (primary) equivalents.

11_ Use recycled plastics for the inner parts of products which have only al supportive function and do not require a high mechanical, hygienic or tolerance quality.

12_ When hygiene is important (as in coffee cups and some packaging) a laminate can be applied, the centre of which is made from recycled plastic, covered with or surrounded by virgin plastic.

13_ Make use of the unique features (such as variations in colour and texture) of recycled materials in the design process.

e> Recyclable materials

14_ Select just one type of material for the product as a whole and for the various sub-assemblies.

15_ Where this is not possible, select mutually compatible materials.

16_ Avoid materials which are difficult to separate such as compound materials, laminates, fillers, fire retardants and fiberglass reinforcements.

17_ Preferably use recyclable materials for which a market already exists.

18_ Avoid the use of polluting elements such as stickers which interfere with recycling.

f> Materials with positive social impact, i.e., by generating local income

19_ Make use of materials supplied by local producers.
20_ Stimulate arrangements for recycling of materials by local companies which can substitute (part of) the raw materials of the company.

2> Reduction of materials usage_

a> Reduction in weight

21_ Aim for rigidity through construction techniques such as reinforcement ribs rather than 'overdimensioning' the product.
22_ Aim to express quality through good design rather than over dimensioning the product.

b> Reduction in (transport) volume

23_ Aim at reducing the amount of space required for transport and storage by decreasing the product's size and total volume.
24_ Make the product foldable and/or suitable for nesting.
25_ Consider transporting the product in loose components that can be nested, leaving the final assembly up to a third party or even the end user.

3> Optimization of production techniques_

a> Alternative production techniques

26_ Preferably choose clean production techniques that require fewer harmful auxiliary substances or additives (for example, replace CFCs in the degreasing process and chlorinated bleaching agents).
27_ Select production techniques which generate low emissions, such as bending instead of welding, joining instead of soldering.
28_ Choose processes which make the most efficient use of materials, such as powder coating instead of spray painting.

b> Fewer production steps

29_ Combine constituent functions in one component so that fewer production processes are required.
30_ Preferably use materials that do not require additional surface treatment.

c> Lower/cleaner energy production

31_ Motivate the production department and suppliers to make their production processes more energy efficient.
32_ Encourage them to make use of renewable energy sources such as wind energy, water power and solar energy. Where possible, reduce the use of fossil fuels and reduce environmental impact by, for example, choosing low-sulphur coal or natural gas.

d> Less production waste

33_ Design the product to minimize material waste, especially in processes such as sawing, turning, milling, pressing and punching.
34_ Motivate the production department and suppliers to reduce waste and the percentage of rejects during production.
35_ Recycle production residues within the company.

e> Fewer/cleaner production consumables

36_ Reduce the production consumables required – for example, by designing the product so that during cutting waste is restricted to specific areas and cleaning is reduced.
37_ Consult the production department and suppliers as to whether the efficiency with which operational materials are used during production can be increased – for example, by good housekeeping, closed production systems and in-house recycling.

f> Safety and cleanliness of the workplace

38_ Choose production technologies that require fewer harmful substances and generate less toxic emissions.
39_ Use production techniques that generate less wastes, and organize efficient in-company re-use and recycle systems for the remaining waste.
40_ Implement systems for in-company working conditions, health and safety like SA8000.

4> Optimization of distribution system_

a> Less/cleaner/reusable packaging

41_ If all or some of the packaging serves to give the product a certain appeal, use an attractive but lean design to achieve the same effect.
42_ For transport and bulk packaging give consideration to reusable packaging in combination with a monetary deposit or return system.
43_ Use appropriate materials for the kind of packaging – for example, avoid the use of PVC and aluminum in non-returnable packaging.
44_ Use minimum volumes and weights of packaging.
45_ Make sure the packaging is appropriate for the reduced volume, foldability and nesting of products – see strategy 2b.

b> Energy efficient transport mode

46_ Motivate the sales department to avoid environmentally-harmful forms of transport.
47_ Transport by container ship or train is preferable to transport by lorry.
48_ Transport by air should be prevented where possible.

c> Energy efficient logistics

49_ Motivate the sales department to work preferably with local suppliers in order to avoid long-distance transport.
50_ Motivate the sales department to introduce efficient forms of distribution – for example, the simultaneous distribution of larger amounts of different goods.
51_ Use standardized transport packaging and bulk packaging (Europallets and standard package module dimensions).

d > Involve local suppliers (distributed economies)

52_ Explore options for contracting more local transport/distribution.
53_ Form logistic consortia with fellow companies in the community to jointly outsource distribution and transport in an efficient way and by involving local distributors.

5> Reduction of impact during use_

a> Low energy consumption

54_ Use the lowest energy consuming components available on the market.
55_ Make use of a default power-down mode.
56_ Ensure that clocks, stand-by functions and similar devices can be switched off by the user.
57_ If energy is used to move the product, make the product as light as possible.
58_ If energy is used for heating substances, make sure the relevant component is well insulated.

b> Clean energy source

59_ Choose the least harmful source of energy.
60_ Do not encourage the use of non-rechargeable batteries – for example, a portable radio can be supplied with a battery charger, encouraging the use of rechargeable batteries;
61_ Encourage the use of clean energy such as low-sulphur energy sources (natural gas and lowsulphur coal), fermentation, wind energy, water power and solar energy. An example is a solar heater which does not require energy for heating water during the summer.

c> Fewer consumables needed

62_ Design the product to minimize the use of auxiliary materials – for example, use a permanent filter in coffee makers instead of paper filters, and use the correct shape of filter to ensure optimal use of coffee.
63_ Minimize leaks form machines which use high volumes of consumables by, for example, installing a leak detector.
64_ Study the feasibility of reusing consumables –reusing water in the case of a dishwasher.

d> Cleaner consumables

65_ Design the product to use the cleanest available consumables.
66_ Make sure that using the product does not result in hidden but harmful wastes – for example, by installing proper filters.

e> Reduce wastage of energy and other consumables

67_ Misuse of the product as a whole must be avoided by clear instructions and appropriate design.
68_ Design the product so that the user cannot waste auxiliary materials – for example, a filling inlet must be made large enough to avoid spillage.
69_ Use calibration marks on the product so that the user knows exactly how much auxiliary material, such as a washing powder, to use.
70_ Make the default state that which is the most desirable from an environmental point of view – for example, 'no cup provided by drinks dispenser' or 'double-sided copies'.

f> Health supporting, social added value

71_ Make sure the product has zero or minimal impact on the health of the user by avoiding use of toxic substances, low radiation levels etc.
72_ Design the product in accordance to the socio-economic needs and possibilities of the user groups.
73_ Assess the opportunities to design products for low-income groups.

6> Optimization of initial lifetime_

a> Reliability and durability

74_ Develop a sound design and avoid weak links. Special methods such as the Failure Mode and Effect Analysis have been developed for this purpose.

b> Easier maintenance and repair

75_ Design the product in such a way that it needs little maintenance.
76_ Indicate on the product how it should be opened for cleaning or repair – for example, where to apply leverage with a screwdriver to open snap connections.
77_ Indicate on the product itself which parts must be cleaned or maintained in a specific way – for example, by colour-coded lubricating points.
78_ Indicate on the product which parts or sub-assemblies are to be inspected often, due to rapid wear.
79_ Make the location of wear on the product detectable so that repair or replacement can take place on time.
80_ Locate the parts which wear relatively quickly close to one another and within easy reach so that replacements are easy to dismantle for repair or replacement.

c> Modular product structure

81_ Design the product in modules so that the product can be upgraded by adding new modules or functions at a later date for example, plugging in larger memory units in computers.
82_ Design the product in modules so that technically or aesthetically outdated modules can be renewed.
For example, make furniture with replaceable covers which can be removed, cleaned and eventually renewed.

d> Classic design

83_ Design the product's appearance so that it does not quickly become uninteresting, thus ensuring that the product's aesthetic life is not shorter than its technical life.

e> Strong product-user relation

84_ Design the product so that it more than meets the (possibly hidden) requirements of the user for a long time.
85_ Ensure that maintaining and repairing the product becomes a pleasure rather than a duty.
86_ Give the product an added value in terms of design and functionality so that the user will be reluctant to replace it.

f> Involve local maintenance and service systems

87_ Design the product with the possibilities of local service and maintenance companies in mind.
88_ Jointly develop new innovative service and repair centers in the region that can be involved both in servicing the new products an existing products.

7> Optimization of end-of-life system_

a> Re-use of product

89_ Give the product a classic design that makes it aesthetically pleasing and attractive to a second user.
90_ Make sure that the construction is sound so that it does not become prematurely obsolete in the technical sense.

b> Remanufacturing/refurbishing

91_ Design for dismantling (from product to sub-assemblies) to ensure easy accessibility of the product for inspection, cleaning, repair and replacement of vulnerable or innovation-sensitive sub-assemblies or parts.
92_ The product should have a hierarchical and modular design structure; the modules can then each be detached and remanufactured in the most suitable way.
93_ Use detachable joints such as snap, screw or bayonet joints instead of welded, glued or soldered connections.
94_ Use standardized joints so that the product can be dismantled with a few universal tools – for example, use one type and size of screw.
95_ Position joints so that the person responsible for dismantling the product does not need to turn it around or move it.
96_ Indicate on the product how it should be opened non-destructively – for example, indicate where and how to apply leverage with a screwdriver to open snap connections.
97_ Locate the parts that are relatively quickly worn out close to one another, so that they can be easily replaced.
98_ Indicate on the product which parts must be cleaned or maintained in a specific way – for example, by using colour-coded lubricating points.

c> Recycling of materials

99_ Give priority to primary recycling over secondary and tertiary recycling.
100_ Design for disassembly (from sub-assemblies to parts).
101_ Try to use recyclable materials for which a market already exists.
102_ If toxic materials have to be used in the product, they should be concentrated in adjacent areas so that they can easily be detached.

d> Safer incineration

103_ The more toxic materials there are in a product, the more the responsible party has to pay for its incineration. Toxic elements should therefore be concentrated and easily detachable so they can be removed, paid for and treated as a separate waste stream.

e> Taking in consideration local (informal) collection recycling systems

104_ Assess the possibilities of existing formal or informal recycling activities in the community to be involved in the take-back and recycling of the product.
105_ Jointly develop and/or support new and efficient collection and recycling systems in the region.