



Basic technical situation in Mongolian hospitals

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Basic technical situation in Mongolian hospitals

Introduction Electricity Water supply Knowledge Summary



This presentation focuses on the following aspects:

Electricity

- What is the main situation in electricity ?
- What problems this situation is causing ?
- What can be done to improve the situation ?

Water supply

- What are the main problems in water supply ?
- What are possible solutions for the problems ?

Knowledge

- What does the workers in hospitals know concerning technology ?





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Introduction Electricity Water supply Knowledge Summary

A. Electricity



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A. Electricity

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Basic problem:

Frequent power outages in districts affect hospitals as well

Most common solution:

Generator outside and several multi-pole sockets to power all equipment (photo)

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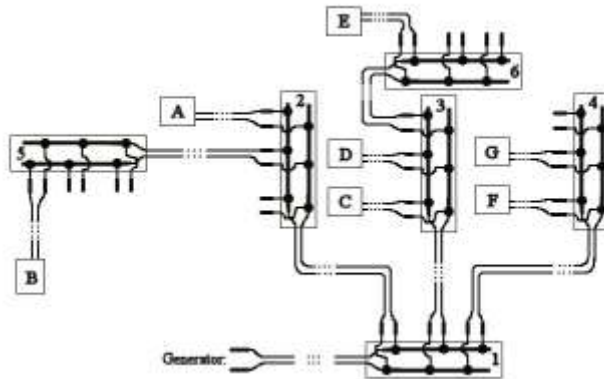


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A. Electricity



Advantages:

Fast installation and energizing of devices

Disadvantages:

1. Potentially dangerous
2. Potentially burnable
3. Potentially device damaging

Figure: Simple scheme of a multi-pole socket network.

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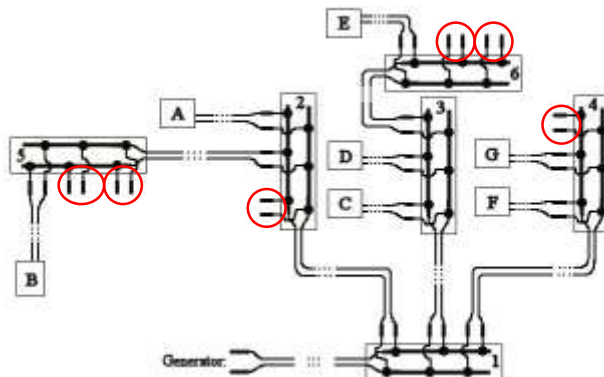


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A. Electricity



- Potentially dangerous:

- a. Cables and sockets on the floor are a hazard for falling
- b. Contact of the sockets with liquids leads to uncontrolled voltage spreading (electric shock)

Figure: Simple scheme of a multi-pole socket network.

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A. Electricity

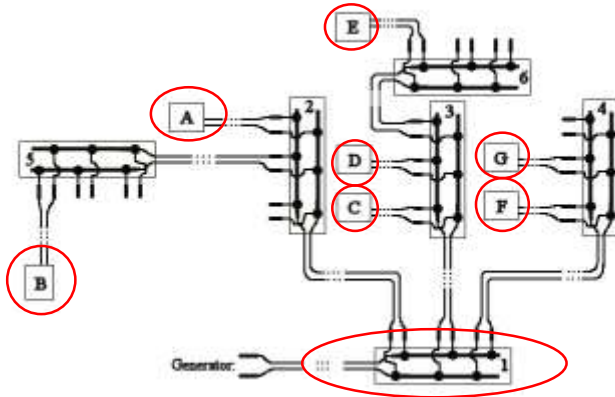


Figure: Simple scheme of a multi-pole socket network.

- Potentially burnable:

- a. Multi-pole sockets have a maximum load

e.g. 220 V and 16 A:
 $\rightarrow 220 \text{ V} * 16 \text{ A} = 3520 \text{ W}$

(only possible, when the cable consists of 1.5 mm² copper)

All devices (A – G) must have less power use together than the maximum load of the first multi-pole socket

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A. Electricity

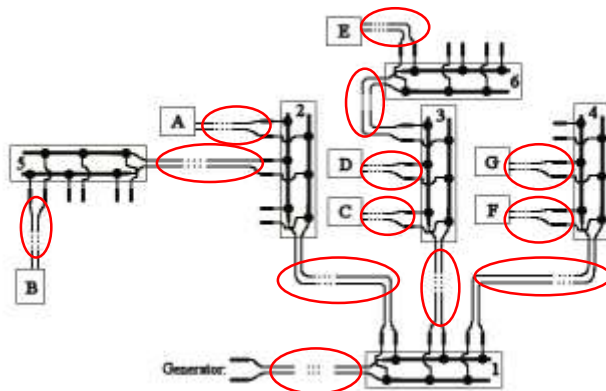


Figure: Simple scheme of a multi-pole socket network.

- Potentially burnable:

- b. High resistance in the system

Many long cables cause high resistance

- Resistance = heat

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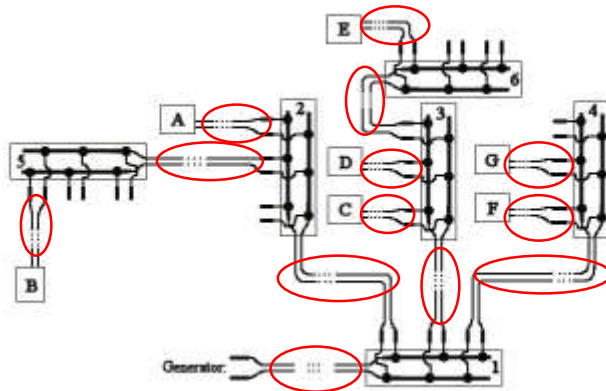


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A. Electricity



- Potentially device damaging:

a. Voltage drop due to high resistance

Less energy (current) arrives at the devices (A – G) than created in the generator

Consequence:
Devices work with less energy than recommended

Figure: Simple scheme of a multi-pole socket network.

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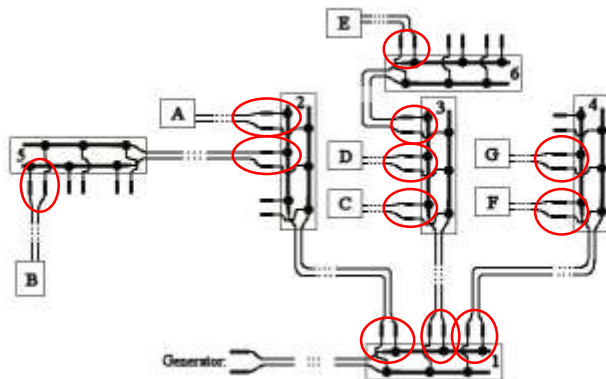


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A. Electricity



- Potentially device damaging:

b. Voltage peaks due to loose contacts

- loose contacts create a high resistance and can cause shutting down and starting up processes

- Every starting up process creates voltage peaks within the system

- Every shutting down process creates voltage peaks outside the system

Figure: Simple scheme of a multi-pole socket network.

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A. Electricity

The better possibility is:

1. Prepare a room for the generator (with ventilation for air exchange)
2. Connect the generator with a specially designed fixed electrical installation (inside the wall or on top of the wall)
3. A generator cannot supply all devices in a hospital. Separate the electrical installation into "important power sockets" and "unimportant power sockets"



Figure: Electric board connecting the generator with the electrical installation (here: ICU generator room, 1st general hospital)

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A. Electricity

Many hospitals have separated electric circuits in all of their rooms.

Power sockets are coded with different colors to visualize their electric circuit

Gray sockets: No electricity while power outage

Green sockets: Electrically supplied by generator, in case of power outage. It can take up to 20 seconds until the energy can be supplied by the generator

Orange/red sockets: Electrically supplied by a battery (Uninterruptible Power Supply). Energy must be reinstalled immediately



Figure: Color coded power sockets in hospitals (source: Gira – building technology)

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A. Electricity

Connecting the generator to the fixed installation:

- By creating a room where the generator is connected
- By creating additional electrical installations supplied by the generator in case of power outage (green power sockets)

Starting the generator alone is much more fast than connecting every device with a network of multi-pole sockets

And it is much more safe...

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A. Electricity

In addition:

Mongolian hospitals often have devices from different countries

Some devices are designed for 110 V, other for 220 V.

Only a few devices can be used for both (Only one at a time)

Connecting a 110 V device to 220 V causes burnings inside the device

Solution: There must be a 110 V electrical installation in addition

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A. Electricity

But every electricity system only can work, when there is a proper protection...

Grounding systems are important to remove "failure energy"

"Surge protection" is important for removing voltage peaks

"High voltage circuit breakers" are necessary to cut electricity before the cable get damage

"Residual current devices" are necessary to shut electricity down, whenever a person gets an electric shock



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A. Electricity

There is an international standard for medical rooms concerning electricity:

IEC 60364-7-710:2002 *Requirements for special installations or locations – Medical locations*

This international standard requires grounding and a protective earth (PE) connection for every power socket (Isolation Network in Operating theatres and ICUs)



Figure: Electric sockets in Mongolia (a) and in most of Europe (b). Electric frequency and Voltage is the same.

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B. Water supply



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B. Water supply

The biggest problem in water supply is the water quality

Many medical devices need clean water supply

Dirty water in hospitals can lead to: illness, infection, contamination



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B. Water supply

To get clean water, Local filter systems are in use to remove dirt (e.g. algae) from the water

Local filter systems have problems:

Many filters get contaminated and dirty, they must be replaced often

→ High costs



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B. Water supply

A central filter system is more effective

Only one filter system must be cleaned regularly

Only possible when the water supply tubes **after** the filter system are clean...



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B. Water supply



SkyJuice Foundation is an Australian Non-Governmental Organization (NGO)

It offers water filtering technology for developing countries (Products from Siemens Water Technologies)

Simple products can filter 6,000 to 10,000 liters of water each day

The system "SkyHydrant" does not require electricity

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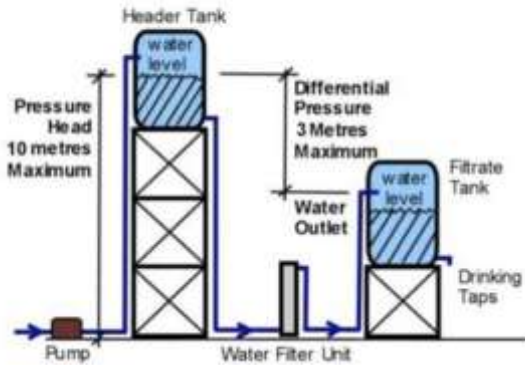
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SkyHydrant – Technical documentation – SkyJuice Foundation

B. Water supply

Water Filter Unit
Operating Presures



Two water tanks are necessary:

1. One for unprepared water
2. One for filtered water

There must be 3 metres of height difference to create water pressure necessary for the water filter operation

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SkyHydrant – Technical documentation – SkyJuice Foundation

B. Water supply



SkyJuice Foundation assumes:

Lifetime of a device: 7 – 10 years

About 20 cent cost per day
(for cleaning and maintenance)

Cleaning procedure:

1. Every day: 5 min. manual cleaning (by rotating the head of the device)
2. Every week: about 20 min. cleaning process with cleaning powder
3. Every Month: Maintenance check

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C. Knowledge



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C. Knowledge



Knowledge is what connects people to find solutions

In hospitals workers must have a certain level of knowledge:

- Medical knowledge
- Hygiene knowledge
- Technical knowledge

Technical knowledge is important as more and more tools and devices are in use

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C. Knowledge



Many devices get damaged because of improper use

e.g.
Using damaged electric cables,

Connecting 110V devices with 220V

No correct instruction about correct installation

No correct instruction about correct use

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C. Knowledge



Problems with missing technical knowledge can be solved in two ways:

1. Effective electrical system designed by technicians and engineers

(No special technical knowledge for hospital workers necessary)

2. Specialized training for hospital workers (e.g. different technical degrees at the Mongolian National University for Medical Sciences)

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D. Summary

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D. Summary

Electrical installations must be stable and reliable for adequate use in hospitals

There are different measures to make an electrical installation safe

Generators, batteries and UPS must be included to make the installation stable

Measures for using the correct voltage for the device must be taken

In Europe and America, the costs for these installations are smaller than the costs for repairing/healing a damage caused by a bad electrical installation

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D. Summary

Water supply must include (cost-) effective filtering

There are inexpensive filtering systems for Households, Hotels, Hospitals and small towns

SkyJuice Foundation is a NGO, which provides assistance for fresh water supply in developing countries

More than 10 years of experience in fresh water supply projects in Asia

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D. Summary

Education is important for Health care systems

Health care workers must get educated properly to know about challenges and problems in the Mongolian Health care system

Technical improvisation leads to danger and problems in the work flow

Health care workers get distracted and cannot focus on their main work

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Thank you for your attention !

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