be compared to the amount of heat produced by 550 thousand million engines 400 hp each.

The heating of the Earth's surfaces is directly proportional to the angle at which solar rays strike the ground. The closer their incidence to perpendicular, the more solar heat is delivered per square centimetre.

CABLES

Choose the proper title for each of the three extracts given below: 1. Cable Components; 2. Cable Insulators; 3. Cable Conductors.

1

The two principal dielectric materials still most commonly used are paper and natural or synthetic vulcanized rubber compounds, but in recent years plastic compounds, as for example polyvinlyl chloride (p.v.c.) and polyethylene (polythene), are being extensively used in place of rubber in many designs.

A paper dielectric is used for all cables where reasonable amounts of power are to be transmitted and where the installation is permanent: for example, supplies to towns, industrial premises, streets, etc., where the cables are usually laid direct in the ground. Rubber- and plastic-insulated cables are used primarily for distribution in factories, mines, ships, etc., where, for example, flexibility is important. Paper-insulated cables have been produced for voltages up to 400 kV. Rubber- and plastic-insulated cables are limited to 11 kV.

Paper dielectric is produced of brown paper usually of a thickness of 0.002—0.010 in. The paper is applied to the conductor in tape form. The number of tapes depends on the transmission voltage. For a 1-kV cable 10 tapes would be used, and for 11-kV cable 20—30 would be applied.

2

Electric cables transmit electrical energy from one point to another. Cables are insulated, for the working voltage, by a composite insulation instead of by air as is used for overhead lines.

The three principal components of a cable are the conductor, the insulation, and the protection.

3

One part of a cable usually consists of high-conductivity annealed copper, and is made up of a number of copper wires connected together for flexibility. The copper is annealed (heat treated) to make it soft which enables the jointing of the individual conductors by twisting without breaking. Aluminium of high purity is also used in place of copper.

CABLES

(continued)

State the difference between "pair" and "quad", between "twin cable" and "star quad cable".

1. Pair consists of two insulated conductors forming a metallic circuit.

Quad is a group of four insulated conductors.

2. Star quad cable is a cable made up of a number of quads. Each quad is formed by twisting four insulated conductors around a common axis. The conductors diagonally opposite each other are the pairs.

Twin cable is a cable containing a number of twisted pairs not in the form of quads.

TEXT

The text below is about cables. Which title will you choose for the text? 1. Some Types of Submarine Cables. 2. Some Types of Cables in Use Nowadays. 3. Some Types of Underground Cables.

Many types of underground (U. G.) cables are used for subscribers' telephone circuits. They are made of copper conductors covered with insulating paper, and contained within a lead sheath. They are known as air-space paper-core cables.

There are three types of these cables in use nowadays. They differ in the way the paper-insulated conductors are grouped in them. In the polythene cable polythene is used for both conductor insulation and sheath. In another type paper is used for insulation of conductors and polythene—for sheathing.

Submarine cables (S.M.) are used for laying direct in the sea, and crossing the beds of rivers and canals. They are known as armoured cables.

There are three types of these cables in use nowadays:
1. Paper-core, air-space, lead-covered,
2. Solid, paper-core, lead-covered,
3. Gutta-percha insulated.

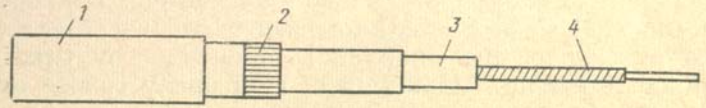


Fig. 11. Submarine cable construction:
1 — jute and compound; *2* — steel armor; *3* — jute; *4* — magnetic tape

The use of each type depends on the electrical properties required and the depth at which it has to be laid. Each cable consists basically of a single conductor surrounded by mechanical and electrical protection.

Submarine cables for telephone work are limited to relatively short distances. One of the longest is the West-Havana cable, which is approximately 125 miles long. The cable has a copper sheath under its armour.

TEXT

Which title will you choose for the text given below? 1. The Advantages of Aluminium Sheathings, or 2. Aluminium Sheathings. Why?

Aluminium is highly used for cable sheathing. Nowadays it is used for sheathing almost as often as load. Aluminium has a number of advantages: the main are its lightness and mechanical strength. It has, however, disadvantages too, such as a high melting point and a chemically-reactive nature. The grade employed has 99,5 per cent purity.

There exist three methods of aluminium sheathing: direct sheathing, welding, and the tube-sinking process.

For most surface installations the aluminium sheath is quite proper, but underground cables need a layer of rubber-like material as a protection against water.

EDUCATIONAL CABLE TV SYSTEM COMPLETED IN TATEYAMA

Read the text. Find in it the paragraph about transmission and feedback channels used in the system.

Japan's first full-scale cable television network for education was completed in Tateyama City. The formal broadcasting service has been started from September.

The purpose of the new system is to give equal education to all schoolchildren in the city both quantitatively and qualitatively through the effective use of teachers and educational facilities. The city's twelve primary schools, seven lower secondary schools, nine kindergartens and ten civic halls were linked with the educational broadcasting centre at the heart of the city.

The TV system has four channels—three for transmission from the centre to the schools and one for feedback from the schools. Moreover, telephone circuits have been installed between the centre and schools so that children's questions may be received and answered at the centre.

The chairman of the city's educational committee emphasized that the new system is by no means a replacement of teachers, but merely a supplemental aid for them.

CABLE FAULT TRACER TYPE 58M

Description

Find answers in the text to the following questions:

1. What is the device designed for?
2. For what kind of operation is it intended?
3. Under what conditions does it operate?
4. Under what conditions does the tropical model of the device operate?
5. Under what conditions are measurements taken?

Cable fault tracer type 58M is designed for measuring the distance to the point of fault in power cables with a voltage of up to 10 kV.

The device is intended for continuous operation within two hours, at an ambient temperature from —20 to +35° C and relative humidity up to 80 per cent. The tropical model of the cable fault tracer type 58M is intended for operation at ambient temperatures from 3 to 45° C and relative humidity up to 95 per cent (at 35° C).

Measurements are taken at the moment of the cable insulation breakdown. The cable under test should be disconnected. High voltage is applied from a high-voltage vacuum-tube rectifier to the disconnected cable.

Measurement Technique

Find answers in the text to the following questions:

1. At what voltage does a short circuit appear (disappear) in the cable?
2. In what parts of cables do breakdowns appear?
3. What method is used to measure the distance to the point of a breakdown?
4. How is the conductor of a damaged cable charged?
5. Where does the insulation breakdown appear in case of a defect?
6. At what moment does a spark appear at the point of fault?

A breakdown in the cable is a short circuit appearing at a high voltage and disappearing at a low voltage. In most cases the breakdowns appear in junction sleeves and are detected during tests of cables by rectified high voltage.

The distance to the point of a breakdown is measured by the method of an oscillatory discharge.

The 58M instrument is connected to the conductor under test through a capacitive voltage divider. The conductor of a damaged cable is charged from a D. C. high-voltage source. The charge voltage is raised up to a breakdown voltage. In case of a defect the insulation breakdown will appear just at the point of fault.

At the moment of breakdown a spark having a very small contact resistance appears at the point of fault, and an oscillatory discharge takes place in the cable.

The distance to the point of fault in kilometres is read directly off the instrument scale.

Principle of Operation

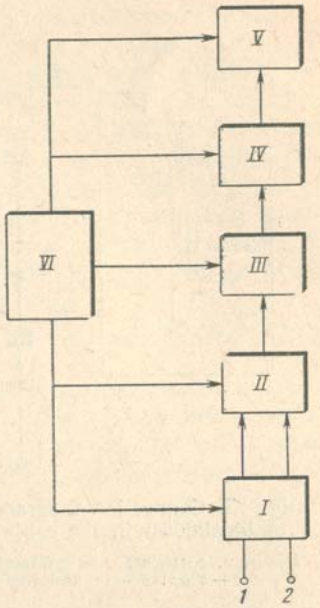
Instrument Block Diagram

Find answers in the text to the following questions:

1. What is the purpose of the block diagram?
2. What components does the device comprise?
3. How many components does the device comprise?
4. By what means is the device connected to the cable under test?

The principle of operation of the 58M instrument is explained in Fig. 12. The device comprises the following components: *I*—control pulse unit; *II*—key valve control unit; *III*—key valve; *IV*—charge circuit; *V*—meter; *VI*—power supply unit.

The device is connected to the cable under test through a capacitive voltage divider. A pulsating voltage is applied through the capacitive voltage divider to the pulse control unit.



Fg. 12. Instrument 58M block-diagram:
1 — trigger; *2* — stop

Care, Storage and Transportation

Find answers in the text to the following questions:

1. How should the device be packed during transportation?
2. What part serves as a support for the device in the field?
3. At what temperature should the device be stored?
4. How much is a relative humidity for the tropical design?

No special requirements are made to the instrument care.

The instrument should be kept clean of dust and dirt. During transportation it should be packed in a box to avoid mechanical damage and to prevent dust and dirt from getting inside the instrument.

When operating in the field, the box can be used as a support for the device.

The instrument should be stored at an ambient temperature from 10 to 35° C and a relative humidity of up to 80 per cent (the tropical design 58M, a relative humidity of up to 70 per cent).

In transportation over short distances take care to exclude impacts and jolts.

TEXT

In the text below pick out all the data on the cable used for carrying out many simultaneous conversations. What type of cable is this?

Paper-insulated lead-covered cables of high standard are used for junction circuits. For longer distances the

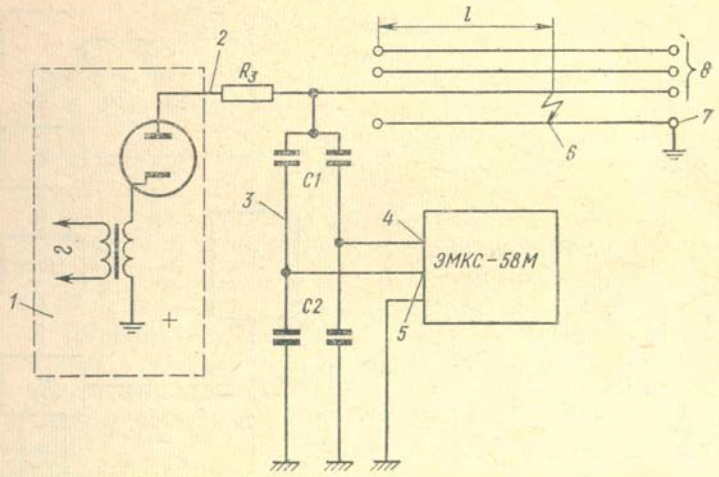


Fig. 13. Connection diagram for measuring a distance to the point of breakdown in the cable by the oscillatory discharge method:

1 — h. v. rectifier; *2* — connecting wire; *3* — voltage divider; *4* — trigger; *5* — stop; *6* — breakdown point; *7* — lead; *8* — cable conductors.

coaxial type of cable was introduced in 1935. In this cable a pair is formed of a central conductor (the axis) and the second conductor in tube formation. This second conductor is separated from the axis by the insulation which may be air or a solid dielectric.

Thanks to the electrical characteristics of this type of construction a coaxial pair is used for a wide band of frequencies. The use of special sending and receiving equipment enables many simultaneous conversations to be carried out by a coaxial pair.

INTERNATIONAL TELEPHONY

Answer the following questions:

1. Which paragraph of the text deals with three types of transmission system?
2. What kind of overseas telephone communication is used for long distances?
3. What kind of scatter radio is used for the Artic?

Both land lines and radio relay systems are employed in international systems.

Water barriers are crossed by submarine cables or radio-telephone systems. Operations of equipment and systems used for international telephone service take place by agreement between governments. In order to organize international exchange of information the International Telecommunication Union (ITU) was founded in 1895.

Overseas telephone service links the telephone systems of many countries and territories throughout the world.

Overseas telephone circuits are largely provided by three transmission systems: high-frequency radio, tropospheric scatter radio, and submarine cable. Each has a definite field of use determined by its own characteristics and limitations.

High-frequency radio systems, the means of overseas telephone communication since 1930, have been widely employed because they can link many countries at great distances and because their flexibility makes them a practical way to provide a few circuits over long distances.

The recently developed tropospheric scatter radio is used for communication over inaccessible areas, such as the Arctic.

Submarine telephone cable systems are free from fading and interference that are characteristic of high-frequency radio systems. Cable systems provide very good transmission, have great circuit capacity and can be used over long distances.

As to high-frequency radio systems, they operate in the 2- to 30-megacycle radio-frequency range, provide up to four telephone channels per system, and operate over long distances. For example, the circuit between Dakland, California, and Bandoeng, Indonesia, extends 8,650 miles. They provide good transmission most of the time but are not free from fading and interference and disturbances in the ionosphere.

RADIO AND TV IN THE USSR

Choose the proper subtitle to the each part of the text:

1. Development of TV in the USSR.
2. Soviet Radio in the Modern World.
3. Radio and TV—Mass Media of Information.
4. The Object of Soviet Broadcasts.
5. The Object of Soviet Radio and TV.
6. Soviet Radio and TV in the Modern World.

1

About eighty years have passed since the day when great Russian scientist Alexander Popov invented his "storm indicator"— the prototype of modern radio receivers. Great progress has been made in radio engineering, radio communication, radio broadcasting, and television since that time. Modern people cannot imagine their life without these things.

In the modern world, radio and television play an important role as a mass media of information and as a means of people's political and cultural education.

2

Modern means of radio engineering cover the greater part of the globe with long, medium, and ultra-short radio waves. New radio stations are being built all over the world. They are equipped with the most modern instruments including transistor devices. The voice of Soviet radio is heard all over the world.

Radio Moscow has been transmitting its programs to other countries for more than forty years. Many listeners have been corresponding with Radio Moscow for several years. Programs to other countries are conducted in many languages.

3

Television is developing rapidly in our country. The construction of the world's biggest television centre, the Moscow centre, housed in the 533-metre high Ostankino television tower, had been completed by 1970.

The steel television tower which is being built in Kiev will be the second highest in the Soviet Union, it will be about 380 metres high.

The object of Soviet specialists' particular attention is colour television which has been functioning since 1967.

4

There is a regular international exchange of TV programs as well. Our television is linked up with the Intervision and Eurovision international systems. We are no longer surprised when we watch a sports telecast from Mexico or Stockholm or even a telecast from outer space.

Work on the improvement of space television and broadcasting is of great interest. The application of powerful outerspace relays makes possible televising programs directly to huge territories.

The object of Soviet radio and TV is to provide the listeners and viewers with reviews of events taking place in the USSR and in the world and to strengthen peace and friendship among nations.

WAVE MOTION

In the text below find the paragraph about radio waves. Answer the following questions:

1. What is the speed of radio waves?
2. In what way do they differ from other wave forms?
3. What devices are used in transmitting sound?

One of the most important phenomena in nature is the transmission of energy from one point to another by wave motion. All wave motions possess three characteristics: (1) amplitude, which is the height or strength of the wave; (2) frequency, the number of waves per second; and (3) wave length, the distance from the crest of one wave to the crest of the next.

Sound waves are produced by vibrations. Sound waves travel through the air at a speed of about 1,100 ft per second.

The microphone, the loudspeaker and headphones are devices used in transmitting sound.

Radio waves are electric waves of very high frequency; they travel through space with the speed of light. They differ from other wave forms such as light waves, heat waves or X-rays only in frequency (number of vibrations per second).

Transmitting antennas send out waves in all directions.

Streamlined TV antenna has a tiny electronic receiving circuit in a slim, winglike plastic housing only $34\frac{1}{8}$ inches wide. This eliminates the need for long arms, yet provide equal or superior signal power. Because of its small size, the antenna can be used indoors in attics as well as on rooftops.

TELEGRAPH

Read the text and find answers to the following questions:

1. Why is the code used nowadays called the Morse code?

2. What are the names of the three scientists who invented and improved the telegraph?

Telegraph is a modern method used for rapid communication. Each letter of the alphabet is coded into dots and dashes. There are intervals between the coded letters and longer intervals between the coded words. The code in common use is called the Morse code after the name of its inventor.

The earliest practical telegraph was invented by Sir Charles Wheatstone, the famous English scientist. It was used in England for several years.

Morse began working on his model in 1832 and completed it in 1837. He proposed that the United States put telegraph into use, and after much debate Congress agreed to build an experimental telegraph line between Washington and Baltimore. On May 24th, 1844, Morse sent his famous message from Washington. He tapped out in code, "What hath[1] God wrought!"[2] His friend, Alfred Vall, at the other end of the line in Baltimore, received the coded electrical impulses and sent a reply.

Many improvements have been made on the Morse telegraph, including one by Thomas Edison, who invented a method of sending four messages over the same line at the same time.

COMMUNICATION LINE FOR 100,000 VOICES

Read the text and say to what means scientists have turned in order to increase the capacity of communication lines.

A plan for an experimental waveguide communication line has been worked out in Moscow. The line will handle simultaneously up to 100,000 telephone conversations and dozens of television programs.

To increase the capacity of communication lines, scientists have turned to millimetre waves, which are capable of transmitting a much larger volume of information. In the new communication line the electromagnetic waves will be transmitted along specific waveguides.

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[1] hath — *устар.* has
[2] wrought — *устар.* made

RADIO ASTRONOMY IN THE USSR

Read the text and say: a) why it is important to study the orbits of artificial Earth satellites; b) by what means studies of the Sun have been made.

The science of radio astronomy was born only about thirty years ago. It has since become the most penetrating of all methods of probing the Universe.

Pulkovo—the leading observatory of the USSR—is situated at a distance of several kilometres from Leningrad. Astronomers are busy finding the exact sites of heavenly bodies. Television helps to increase 500-600 times the brightness of the pictures of heavenly bodies obtained by an optical telescope.

Today the scientists study activity of the Sun, follow the flights of Earth sputniks and calculate their orbits. The scientists of the observatory have made a valuable contribution to the study of the cosmos by observing the Soviet artificial Earth satellites, man-made Moons. The study of their orbits is very important for the flights of manned spaceships.

The Pulkovo Observatory has a radio-astronomy department equipped with modern apparatus. The big radio-telescope was created some years ago. With the help of this powerful device the scientists of the Pulkovo Observatory carry out a number of observations of Venus, Jupiter and other planets. It is necessary that before flying to other planets scientists should get the greatest possible information about the heavenly bodies.

The astronomers have obtained extremely surprising results due to radio-astronomical observation. By means of the radio-telescope some remarkable studies of the surface of the Sun and of solar activity have been made and a method of investigating the movement of planets has been worked out.

For thousands of years people have been conducting observations of the planets of the solar system. Now they are conquering space. Due to the cosmonauts' flights scientists can get answers to many fundamental questions concerning space.

The Soviet scientists, technicians and workers have produced and launched interplanetary stations in the direction of the Moon, Venus, and Mars. Ships flying in space serve the interests of all the peoples of the world.

GIANT TELESCOPE

Read the text and find in it figures characterizing the dimensions and range of full rotation of the Mark 1 Radio Telescope.

Jodrell Bank is the name that in recent years has become well known among astronomers in every continent, for this was the place chosen by the University of Manchester (Department of Radio Astronomy) for large fully steerable telescopes.

It was the intensive war-time development of radio and radar techniques that stimulated the development of radio astronomy and gave astronomy a new and powerful tool for the exploration of space.

The science of radio astronomy was born only about a quarter of a century ago. It has since become the most penetrating of all methods of probing the physical universe. The idea of a large and completely steerable radio telescope was first fulfilled in 1957 in the construction of the Mark 1 Radio Telescope. The instrument is so penetrating that it can receive radio waves from distances of thousands of millions of light years away. It enables the staff of Manchester University's Department of Radio Astronomy to calculate time in terms of many million light years.

The Mark 1 Radio Telescope took three and a half years to build, cost £ 700,000 and weighs 2,000 tons. The diameter of the reflector is 250 feet and it is calculated that 10,000 people could sit in comfort within it. One full rotation of the reflector takes 15 minutes, while the supporting structure carrying the reflector can make one full rotation (freely in horizontal and vertical plane) in 18 minutes. With this timing, the outer parts move at a speed of about $^3/_4$ mile per hour.

Since the construction of the Mark I model, a smaller and more accurately formed telescope, with a precise control system, has been introduced. This is Mark II, which came into use in 1964. Driven by a digital computer, Mark II enables radio-astronomical researches at Jodrell Bank to be extended to wave-length of a few centimetres. The diameter of the reflector is 125 feet. The Jodrell Bank telescopes are dedicated to pure astronomical research, and for a number of years their penetration, power gain and discrimination will be applied to a study over a wide range of wave-lengths, of the position, distances and distribution of radio sources embracing the Milky Way system sources localized within the system and sources in extragalactic space.

Nothing less than a map of the universe is the purpose of this research.

TELEVISION AND RADIO IN THE USSR

The modern information explosion cannot be conceived without TV and radio. These media bring the people news and diverse scientific and social information, music and theatrical high-lights, as well as the best in literature and the arts.

The importance of radio has not lessened with the appearance of television. That is because there still is a vast territory not reached by television and where radio remains the chief source of timely information. The other reason that its significance has not lessened is that with every year more and more motorcars make their appearance in towns and villages. Every new motorcar means a new radio receiver.

In recent years many new radio relay lines have been set up and the cable network has been extended. Cosmic transmitters have made their appearance, and TV has become accessible in remote area of the country. The main TV centre is situated in Moscow. It is fitted out with the most modern equipment. It has more than 20 studios and a concert hall from which telecasts are transmitted. The TV transmission tower near the TV centre is the highest structure in the world.

Many programs, especially those involving audiences, are transmitted from the TV theatre. However, this does not cover all the studio potentialities of the Moscow TV centre. The big concert halls and theatres in Moscow, such as the Kremlin Palace of Congresses, the Hall of Columns of the House of Trade Unions, the Bolshoi Theatre, the Moscow Art Theatre, the Operetta Theatre, and others, are equipped with TV apparatus. Transmissions are conducted from other concert halls and theatres in the capital with the help of mobile TV stations.

We exchange programs with other socialist countries within the framework of intervision.

It should be added that the population of the Soviet Union pay no fee for television. Now there is no licence

necessary—all expenses are covered by state budget allocations.

Soviet television and radio do not have to worry about any other sources of income. People in the USSR do not need to devote time to commercials to make money. They receive enough money from the state to produce TV films and theatrical pieces at our studios, and to order TV films from cinefilm studios. Television enjoys free use of all Soviet documentaries at any time in its programs. Feature films produced by our studios are also shown by TV.

An acquaintance with TV and radio programs shows that Soviet radio and television have but one purpose, and that is to serve the people, to keep them informed, to disseminate knowledge, to extend education and to provide cultural recreation.

Radio and television satisfy the diverse interests of televiewers and radio listeners in the best way possible. In addition to the news which, as a rule, is of general interest, the programs daily include broadcasts for differrent sections of the population, for young people, for children, for people of different professions, for serious music enthusiasts, for lovers of light music, for sport fans, etc.

Moscow broadcasts over four radio programs. Moscow TV has the same number of channels. Channel 1 is a countrywide program—it covers the greatest territory and is relayed by all local TV stations. Channel 2 is intended mainly for the central areas of the country. Channel 3 is devoted entirely to scientific and educational programs. Channel 4 is given over exclusively to the theatre, symphony and variety music, films and poetry.

The TV programs pay much attention to children of varying ages. There are films for them, plays, various TV magazines and, of course, animated cartoons which also attract adult audiences.

The Soviet Union is a multinational country. It is natural, therefore, that in addition to the Moscow TV and radio studios, all the Union and Autonomous Republics, National Areas and large regional centres have their own TV and radio studios. The different republics have TV and radio broadcasts in their national languages. They release their own films, dramatic and musical productions, and produce their own science and educational series.

LIST OF ABBREVIATIONS

A anode
a ampere
a. c. alternating current
A. C. alternating current (industry)
AC armored cable
AM amplitude-modulated
ant. antenna
APC auxiliary power supply
db decibel
d. c. direct current
D. C. direct current (industry)
e.m.f. electromotive force
fd farad
Fig. figure
FM field manual
FM frequency-modulated
ft foot
h henry
H horizontal
HE heavy equipment
hp high pressure
hp horsepower
in inch
kV kilovolt
kW kilowatt
kWh kilowatt-hour
L coil
LW long wave
M microphone
MC megacycle
mi mile
mic microphone
mid middle
mh millihenry
mm millimetre
mu microne
mV millivolt
mW milliwatt
MW medium wave
Mw megawatt
p. m. post meridiem
PM permanent magnet
RF radio frequency
RFA radio-frequency amplifier
SA switching devices
scrn screen
snd sound
SW short wave
sym symbol
t time
tel telephone
telecom telecommunications
temp. temperature
TRF tuned radio frequency
TV television
UHF ultra-high frequency
V volt
V vertical
VDC volt, direct current (industry)
VF video frequency
VHF very high frequency
VLF very low frequency
w watt
WF four-conductor cables
whr watt-hour