

Министерство науки и высшего образования Российской Федерации
Федеральное государственное бюджетное образовательное учреждение
высшего образования
**«Псковский государственный университет»
(ПсковГУ)**

Образовательный департамент ПИШ Союзного государства в ПсковГУ

**ФОНД ОЦЕНОЧНЫХ СРЕДСТВ
ПРОМЕЖУТОЧНОЙ АТТЕСТАЦИИ ОБУЧАЮЩИХСЯ
ПО ДИСЦИПЛИНЕ
(закрытая часть)**

**Б1.О.М.02.01
ИНОСТРАННЫЙ ЯЗЫК ДЛЯ ПРОФЕССИОНАЛЬНОЙ КОММУНИКАЦИИ**

Направление подготовки 13.04.02 Электроэнергетика и электротехника

Профиль ОПОП ВО: «Электроприводы и системы управления электроприводов»

Форма обучения: очная, очно-заочная, заочная

Квалификация выпускника: магистр

Фонд оценочных средств рассмотрен и утвержден на заседании кафедры иностранных языков для нелингвистических направлений « _____ » _____ 20____ г., протокол от « _____ » _____ 20____ г. № _____

Зав. кафедрой иностранных языков
для нелингвистических направлений



(И.Н. Коротчкая)

« _____ » _____ 20____

Обновление фондов оценочных средств по дисциплине:
на 20____/20____ уч.год:

фонды оценочных средств обновлены в соответствии с решением кафедры иностранных языков для нелингвистических направлений протокол № _____ от _____

на 20____/20____ уч.год:

фонды оценочных средств обновлены в соответствии с решением кафедры иностранных языков для нелингвистических направлений протокол № _____ от _____

Фонд оценочных средств рассмотрен и утвержден на заседании кафедры иностранных языков для нелингвистических направлений 25 января 2023 г., протокол от «25» января 2023 г. № 6

Зав. кафедрой иностранных языков
для нелингвистических направлений



(И.Н. Коренецкая)

«25» января 2023 г.

Обновление фондов оценочных средств по дисциплине:

на 20___/20___ уч.год:

фонды оценочных средств обновлены в соответствии с решением кафедры иностранных языков для нелингвистических направлений протокол №_____ от _____

на 20___/20___ уч.год:

фонды оценочных средств обновлены в соответствии с решением кафедры иностранных языков для нелингвистических направлений протокол №_____ от _____

1. Перечень компетенций с указанием этапов их формирования в процессе освоения ОПОП ВО

В соответствии с требованиями ФГОС ВО, утв. Минобрнауки РФ от 28.02.2018 № 147 и учебным планом ОПОП ВО по направлению подготовки 13.04.02 Электроэнергетика и электротехника, процесс изучения дисциплины направлен на формирование следующих компетенций:

УК-4. Способен применять современные коммуникативные технологии, в том числе на иностранном(ых) языке(ах), для академического и профессионального взаимодействия.

УК-5. Способен анализировать и учитывать разнообразие культур в процессе межкультурного взаимодействия.

№ п/п	Шифр комп.	Этапы формирования компетенций		
		Начальный этап	Основной этап	Завершающий этап
4	УК-4	Б1.О.М.02.01 Иностранный язык для профессиональной коммуникации	Б1.О.М.02.01 Иностранный язык для профессиональной коммуникации Б2.О.М.02(У) Ознакомительная практика	Б3.02 Подготовка к процедуре защиты и защита выпускной квалификационной работы
5	УК-5	Б1.О.М.01.01 Методология научного исследования Б1.О.М.02.01 Иностранный язык для профессиональной коммуникации Б1.О.М.02.02 Инструменты проектного управления Б1.О.М.01.01(У) Учебная практика «Развитие профессиональной карьеры»	Б1.О.М.02.01 Иностранный язык для профессиональной коммуникации	Б1.О.М.02.01 Иностранный язык для профессиональной коммуникации Б3.02 Подготовка к процедуре защиты и защита выпускной квалификационной работы

2. Требования к результатам освоения дисциплины (модуля)

№ п/п	Индекс компетенций	Описание индикаторов достижения компетенций	Перечень планируемых результатов обучения по дисциплине (модулю), соотнесенных с индикаторами достижения компетенций
1	УК-4. Способен осуществлять деловую коммуникацию в устной и письменной формах	ИУК 4.1. Знает: принципы коммуникации в профессиональной этике; факторы улучшения коммуникации в организации, коммуникационные технологии в профессиональном взаимодействии;	Знает: - базовую лексику по сферам применения (терминологическая, общенаучная) лексических

	на государственном языке Российской Федерации и иностранном(ых) языке(ах)	характеристики коммуникационных потоков; значение коммуникации в профессиональном взаимодействии; методы исследования коммуникативного потенциала личности; современные средства информационно-коммуникационных технологий	<p>единиц;</p> <ul style="list-style-type: none"> - грамматический материал изучаемого языка; - правила орфографии и пунктуации, нормы письменной речи, принятые в стране изучаемого языка; - правила речевого этикета; межкультурные особенности и правила коммуникативного поведения в ситуациях делового, профессионального общения.
		ИУК 4.2. Умеет: создавать на русском и иностранном языке письменные тексты научного и официально-делового стилей речи по профессиональным вопросам; исследовать прохождение информации по управленческим коммуникациям; определять внутренние коммуникации в организации; производить редакторскую и корректорскую правку текстов научного и официально-делового стилей речи на русском и иностранном языке; владеть принципами формирования системы коммуникации; анализировать систему коммуникационных связей в организации	<p>Умеет:</p> <ul style="list-style-type: none"> - понимать устные сообщения делового и профессионального характера в монологической и диалогической формах на иностранном языке; - продуцировать монологическую речь в деловой и профессиональной коммуникации на иностранном языке; - работать с источниками информации на иностранном языке.
		ИУК 4.3. Владеет: реализацией способов устной и письменной видов коммуникации, в том числе на иностранном языке; представлением планов и результатов собственной и командной деятельности с использованием коммуникативных технологий	<p>Владеет:</p> <ul style="list-style-type: none"> - навыками реализации коммуникативных намерений в устной и письменной речи; - навыками всех видов чтения (изучающего, просмотрового, поискового) литературы по профессиональным вопросам.
2	УК-5. Способен воспринимать межкультурное разнообразие общества в социально-историческом, этическом и философском контекстах	ИУК 5.1. Знает: психологические основы социального взаимодействия; направленного на решение профессиональных задач; основные принципы организации деловых контактов; методы подготовки к переговорам, национальные, этнокультурные и профессиональные особенности и народные традиции населения; основные концепции взаимодействия людей в организации,	<p>Знает:</p> <ul style="list-style-type: none"> - культурные особенности страны изучаемого языка; - способы эффективного межличностного взаимодействия; - основы профессиональной солидарности и корпоративности, понимание

		особенности диадического взаимодействия	<p>долга и чести;</p> <ul style="list-style-type: none"> - языковой материал изучаемого языка (лексика, грамматика, структурные и языковые модели) в объеме и на уровне, определенном Советом Европы как B2, в том числе: - базовую нормативную грамматику в активном владении и основные грамматические конструкции для пассивного восприятия; - стилистически нейтральную наиболее употребительную лексику, относящуюся к общеупотребительному языку и терминологическую лексику – общий объем – 2000 учебных лексических единиц; - интернациональную лексику.
		ИУК 5.2. Умеет: грамотно, доступно излагать профессиональную информацию в процессе межкультурного взаимодействия; соблюдать этические нормы и права человека; анализировать особенности социального взаимодействия с учетом национальных, этнокультурных, конфессиональных особенностей	<p>Умеет:</p> <ul style="list-style-type: none"> - использовать английский язык в бытовом (неформальном) общении и учебной ситуации; использовать не менее 900 терминологических единиц терминологических элементов; - воспринимать общее содержание текстов заданного уровня сложности общего и профессионально-ориентированного характера; - решать производственные вопросы на профессиональном уровне, найти контакт со всеми членами коллектива.
		ИУК 5.3. Владеет: организацией продуктивного взаимодействия в профессиональной среде с учетом национальных, этнокультурных, конфессиональных особенностей; преодолением коммуникативных, образовательных, этнических, конфессиональных и других барьеров в процессе межкультурного взаимодействия; выявлением	<p>Владеет:</p> <ul style="list-style-type: none"> - знаниями профессиональной этики в объеме, позволяющем вести организационно-управленческую работу в коллективе на высоком современном уровне; - иностранным языком в объёме

		<i>разнообразия культур в процессе межкультурного взаимодействия</i>	<i>необходимом для возможности коммуникации и получения информации из зарубежных источников.</i>
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3. Паспорт фонда оценочных средств по дисциплине

№ п/п	Индекс контролируемой компетенции (или её части)	Контролируемые разделы дисциплины	Оценочные средства и технологии оценки (наименования и номера заданий)
1 1.1	<i>УК-4. Способен осуществлять деловую коммуникацию в устной и письменной формах на государственном языке Российской Федерации и иностранном(ых) языке(ах)</i>	<i>Знает:</i> - базовую лексику по сферам применения (терминологическая, общенаучная) лексических единиц; -грамматический материал изучаемого языка; - правила орфографии и пунктуации, нормы письменной речи, принятые в стране изучаемого языка; - правила речевого этикета; <i>межкультурные особенности и правила коммуникативного поведения в ситуациях делового, профессионального общения.</i>	<i>Тест (вопросы 1-40) Экзамен (Билеты № 1-10)</i>
1.2		<i>Умеет:</i> - понимать устные сообщения делового и профессионального характера в монологической и диалогической формах на иностранном языке; - продуцировать монологическую речь в деловой и профессиональной коммуникации на иностранном языке; - работать с источниками информации на иностранном языке.	<i>Тест (вопросы 1-40) Экзамен (Билеты № 1-10)</i>
1.3		<i>Владеет:</i> - навыками реализации коммуникативных намерений в устной и письменной речи; - навыками всех видов чтения (изучающего, просмотрового, поискового) литературы по профессиональным вопросам.	<i>Тест (вопросы 1-40) Экзамен (Билеты № 1-10)</i>
2 2.1	<i>УК-5. Способен воспринимать межкультурное разнообразие общества в социально-историческом, этическом и философском контекстах</i>	<i>Знает:</i> - культурные особенности страны изучаемого языка; - способы эффективного межличностного взаимодействия; -основы профессиональной солидарности и корпоративности, понимание долга и чести - языковой материал изучаемого языка (лексика, грамматика, структурные и языковые модели) в объеме и на уровне, определенном Советом Европы как B2, в	<i>Тест (вопросы 1-11,13-15,19,21,27,28,30-40) Экзамен (Билеты № 1-10)</i>

Although there are only two main ... (7) of energy, it may be found in different forms like light, mechanical, electric or sound energy. Most of these forms of energy can be changed from one into the other.

However, it must be remembered that the total ... (8) of energy in the Universe does not... (9). The reason for this is that energy and matter can change into each other without any loss. Thus the total amount of matter and energy in the universe is believed to remain ... (10).

II. Заполните пропуски

11. Franklin's achievements in the field of electricity ... to Lomonosov who, in his turn, made experiments of his own.

a) was known; b) have been known; c) had been known; d) were known.

12. As soon as the electric energy ... at the power station, it is to be transmitted over wires to the substation and to the consumer.

a) will be produced; b) is produced;
c) was produced; d) had been produced.

13. Since the oil crises of the 1970's international cooperation ... an increasingly important factor in energy policy for most countries of the industrial world.

a) had become; b) became; c) has become; d) was.

14. Energy cooperation not only ... to economic development but also to peace and stability for the countries.

a) contributes; b) is contributing;
c) has contributed; d) had contributed.

15. Between 1987 and 1997 Latin America ... the highest annual rate of growth of energy production at 5 percent.

a) has; b) had; c) has had; d) had had.

16. Hydroelectric power plants ... the kinetic energy contained in falling water into electricity.

a) are converting; b) converted;
c) convert; d) have converted.

17. We want the atomic energy ... for peaceful construction.

a) to be used; b) to use; c) to have been used; d) is used.

18. The great expansion in the nuclear reactor field places increased emphasis ... the problem of reactor control.

a) on; b) in; c) at; d) for.

19. Hydropower is currently the world's largest renewable source of electricity, accounting ... 6% of worldwide energy supply.

a) in; b) at; c) by; d) for.

20. Much of the fuel produced in Russia is converted to electricity, about three-fourths of which is generated ... thermal stations.

a) at; b) in; c) on; d) with.

21. Fleming ... the thermionic valve in 1904.

a) has developed b) will develop c) developed d) was developed

22. The action of the transistors ... on the behavior of electrons in semiconductors.

a) had relied b) are relied c) relies d) were relied

23. We were said that the transformer ... to increase and decrease the voltage.
a) allow b) allowed c) allows d) has allowed
24. It was _____ set of instructions I had ever received.
a) more confusing
b) the most confusing
c) as confusing as
25. An electric charge ... pass easily through some materials.
a) may b) can c) must d) ought to
26. The generator ... be repaired as soon as possible.
a) can b) may c) must d) ought to
27. The generator, a new source of electricity ... in Paris.
a) has been developed b) had been developed c) was developed
28. Cable television first... in 1949 as a means of transmitting TV signals to rural areas.
a) had appeared b) has appeared c) appeared
29. Complex systems of radio transmission networks ... in this area before he came to work there.
a) were set up b) have been set up c) had been set up
30. The Nobel Prize takes its name from its founder, the Swedish chemist and engineer Alfred Nobel who was the ... of dynamite.
a) invent b) inventor c) invention

III. Прочтите текст:

International Forum for Energy

Dear Delegates,

I am delighted to have the opportunity to speak to you all at the tenth International Forum for Energy. The main focus of my talk will be on how we are all ambassadors, not only for our companies or organizations but also for our industry as a whole. We all need to be aware of the challenges that face us - particularly our image concerning the issue of the environment - and we all have to be more proactive regarding this matter.

ELEC statistics are representative of the industry as a whole and speak for themselves. 40% of our generating capacity is accounted for by lignite and coal, 25% by gas, 20% is attributable to nuclear energy, and just 15% accounted for by hydro and renewables. The industry is therefore seen by the public as one of the main culprits regarding climate change, air pollution, rising sea levels, and other environmental problems including the hole in the ozone layer.

This is despite the fact that we have invested a lot of effort and money in finding solutions. All fossil fuel plants have been fitted with desulphurization plants to reduce emissions of greenhouse gases such as sulphur dioxide - one of the main causes of acid rain. We have also developed combustion technology to decrease carbon dioxide emissions, and we have installed denox equipment to reduce nitrogen oxides. We are also heavily involved in emissions trading.

There are many, particularly in the media and in politics, who would wish to highlight the negative aspects without even mentioning the measures that we have implemented over the last few years. This forum will give us all the opportunity to discuss the issues and challenges so that we are able to respond in a professional and appropriate manner.

I am sure that we will have some very interesting and thought-provoking discussions.

Jane Hall
Chief Executive Officer

Укажите:

- a) утверждение соответствует тексту;
- b) утверждение не соответствует тексту.

31. People see the energy industry as 'clean'.

32. Gas is the least important source in the ELEC's energy mix.

33. Nuclear energy makes up 15% of generating capacity.

34. ELEC has invested a lot of money in technology to reduce emissions.

35. It is well known that a lot of measures to reduce emissions have been implemented.

36. Managers have to be able to answer questions concerning their companies' environmental record.

("English for the Energy Industry", Simon Campbell)

IV. Выберите верный комментарий

37.

Inter-Office Memo	
From:	Philip Jones
To:	Mike Williams
Subject:	Finance meeting, 10 a.m., Friday June 8
<p>I am free at 10.00 on Friday, but only for about an hour. Could we have the finance meeting in the afternoon, if possible? There's a lot to discuss. I'm free from 2 o'clock. If we can begin then it would give us the whole afternoon.</p>	

- A Can you cancel the 10 o'clock meeting on Friday?
- B Can you reschedule the finance meeting for 2 o'clock?
- C Can you make the meeting on Friday morning shorter?

38.

WARNING

This machine has three cable inputs, clearly labeled A, B and C. Input A is permanently connected and cannot be removed. For your safety, cable inputs B and C should only be connected when the Power switch is OFF.

It would be dangerous to

- A switch off the power when input A is connected.
- B connect input B with the power off.
- C connect input C with the power on.

39.

... See enclosed brochure for details and levels of compensation.

- A You should write to us for details about compensation.
 B Details about compensation are given in a separate document.
 C You will find more information on compensation on the next page.

40.

"All products, wherever manufactured, conform to both the new British and European Standards so their safety is assured."

- A The products are guaranteed to be safe.
 B All the products are British or European.
 C The British and European products conform to new standards.

Ключи для варианта 1

№ вопроса	Ответ
1	ability
2	matter
3	measured
4	heat
5	motion
6	position
7	kinds
8	amount
9	change
10	constant
11	d
12	b
13	c
14	a
15	b
16	c
17	a
18	a
19	d
20	b
21	c
22	c
23	b
24	b
25	b
26	c
27	c
28	c
29	c
30	b
31	b
32	b
33	b
34	a
35	b
36	a
37	B

38	B
39	B
40	A

Вариант 2

Лексико-грамматический тест

I. Заполните пропуски, выбрав верное слово:

Before writing this letter; Dear Anna; He assured me; I look forward to hearing from you; I therefore suggest; May I remind you; I might add; We are extremely concerned; Yours sincerely;

Association of European Chemical Producers
Energy Procurement Unit
Oranjeweg 118 • 3014 LA Rotterdam • Netherlands

Ms Anna Smith ELEC
International Business Sales
Unit Hohewall 34 D-10423
Berlin Germany
10 April 20..

_____(1)

I was somewhat dismayed to find out that just three weeks after I had signed the purchase contract with ELEC for our organization there was a sudden and complete breakdown in electricity supply to two of our members' production facilities in the Netherlands. _____ (2) that under the terms of our agreement ELEC is obliged to guarantee security of supply.

_____ (3) I spoke to one of ELEC's engineers. He went into great technical detail about power surges and outages in the surrounding areas. _____ (4) that it was only due to our own circuit breakers that our plants were not severely damaged.

_____ (5) that his team was working around the clock to remedy the situation. He implied it was force majeure; this remains to be verified.

_____ (6) about the situation and are questioning whether ELEC can supply power to all our production locations throughout Europe.

_____ (7) we meet to discuss this most unfortunate state of affairs. I propose this meeting should take place at our headquarters in Rotterdam next week on Tuesday, April 17th at 10.00 a.m.

_____. (8)

_____, (9)

Dr. Paul Robben,
Managing Director
AECF Energy Procurement Unit

("English for the Energy Industry", Simon Campbell)

II. Выберите верный комментарий

WARNING

This machine has three cable inputs, clearly labeled A, B and C. Input A is permanently connected and cannot be removed. For your safety, cable inputs B and C should only be connected when the Power switch is OFF.

It would be dangerous to

A switch off the power when input A is connected.

B connect input B with the power off.

C connect input C with the power on.

III. Заполните пропуски

11. Franklin's achievements in the field of electricity ... to Lomonosov who, in his turn, made experiments of his own.

a) was known; b) have been known; c) had been known; d) were known.

12. As soon as the electric energy ... at the power station, it is to be transmitted over wires to the substation and to the consumer.

a) will be produced; b) is produced;
c) was produced; d) had been produced.

13. Since the oil crises of the 1970's international cooperation ... an increasingly important factor in energy policy for most countries of the industrial world.

a) had become; b) became; c) has become; d) was.

14. Energy cooperation not only ... to economic development but also to peace and stability for the countries.

a) contributes; b) is contributing;
c) has contributed; d) had contributed.

15. Between 1987 and 1997 Latin America ... the highest annual rate of growth of energy production at 5 percent.

a) has; b) had; c) has had; d) had had.

16. Hydroelectric power plants ... the kinetic energy contained in falling water into electricity.

a) are converting; b) converted;
c) convert; d) have converted.

17. We want the atomic energy ... for peaceful construction.

a) to be used; b) to use; c) to have been used; d) is used.

18. The great expansion in the nuclear reactor field places increased emphasis ... the problem of reactor control.

a) on; b) in; c) at; d) for.

19. Hydropower is currently the world's largest renewable source of electricity, accounting ... 6% of worldwide energy supply.

a) in; b) at; c) by; d) for.

20. Much of the fuel produced in Russia is converted to electricity, about three-fourths of which is generated ... thermal stations.

a) at; b) in; c) on; d) with.

21. Fleming ... the thermionic valve in 1904.
a) has developed b) will develop c) developed d) was developed
22. The action of the transistors ... on the behavior of electrons in semiconductors.
a) had relied b) are relied c) relies d) were relied
23. We were said that the transformer ... to increase and decrease the voltage.
a) allow b) allowed c) allows d) has allowed
24. It was _____ set of instructions I had ever received.
a) more confusing
b) the most confusing
c) as confusing as
25. An electric charge ... pass easily through some materials.
a) may b) can c) must d) ought to
26. The generator ... be repaired as soon as possible.
a) can b) may c) must d) ought to
27. The generator, a new source of electricity ... in Paris.
a) has been developed b) had been developed c) was developed
28. Cable television first... in 1949 as a means of transmitting TV signals to rural areas.
a) had appeared b) has appeared c) appeared
29. Complex systems of radio transmission networks ... in this area before he came to work there.
a) were set up b) have been set up c) had been set up
30. The Nobel Prize takes its name from its founder, the Swedish chemist and engineer Alfred Nobel who was the ... of dynamite.
a) invent b) inventor c) invention

IV. Прочтите текст:

Another silicon valley?

Wind power works, and will work better in the future. But wind is only an interim stop on the way to a world where electricity no longer relies on fossil fuels. The ultimate goal is to harvest the sun's energy directly by intercepting sunlight.

Inventors love that sort of problem. Ideas they have come up with range from using the sun to run simple heating systems for buildings to nanotechnology, to ensure that every last photon is captured and converted into electricity. The most iconic form of solar power, the photovoltaic cell, is currently the fastest - growing type of alternative energy. The price of electricity it produces is falling. Photovoltaic cells (or solar cells) convert sunlight directly into electricity. But that is not the only way to use the sun to make electrical power. It's also possible to concentrate the sun's rays, use them to boil water and employ the resulting steam to drive a turbine.

These two very different approaches illustrate an unresolved question about the future of energy: whether it will be generated centrally and transported over long distances to the consumers, or generated and consumed in more or less the same place, as it was a century ago.

The idea of solar cells is to keep things local. Even a single solar panel can produce power immediately. Put a few on your roof and, if you live in a reasonably sunny place, you can cut your electricity bill. You may be able to sell electricity to your power company.

Some engineers look for big technological improvements in the way solar cells work. Dr. Sach of MIT invented a technique called the string ribbon, which halved the amount of silicon needed to make a solar cell by drawing the element in liquid form out of a vat between two strings. That invention was marked by a firm called Evergreen Solar.

Укажите:

- a) утверждение соответствует тексту;
- b) утверждение не соответствует тексту.

- 31. Nowadays electricity relies only on fossil fuels.
- 32. Solar power can run heating systems in buildings.
- 33. The price of electricity produced by photovoltaic cells is growing.
- 34. There are different ways to use the sun in producing electricity.
- 35. A single panel can't produce electricity.
- 36. There is only one approach illustrating the future of energy.
- 37. You can get electricity by putting a few panels on your roof.
- 38. Engineers are not interested in the ways solar cells work.
- 39. Dr. Sach's technique needs silicon for making a solar cell.

V. Выберите верный комментарий

40.

Inter-Office Memo

From: Philip Jones

To: Mike Williams

Subject: Finance meeting, 10 a.m., Friday June 8

I am free at 10.00 on Friday, but only for about an hour. Could we have the finance meeting in the afternoon, if possible? There's a lot to discuss. I'm free from 2 o'clock. If we can begin then it would give us the whole afternoon.

- A Can you cancel the 10 o'clock meeting on Friday?
- B Can you reschedule the finance meeting for 2 o'clock?
- C Can you make the meeting on Friday morning shorter?

Ключи для варианта 2

№ вопроса	Ответ
1	Dear Anna
2	May I remind you
3	Before writing this letter
4	I might add
5	He assured me
6	We are extremely concerned
7	I therefore suggest
8	I look forward to hearing from you

9	Yours sincerely
10	B
11	d
12	b
13	c
14	a
15	b
16	c
17	a
18	a
19	d
20	b
21	c
22	c
23	b
24	b
25	b
26	c
27	c
28	c
29	c
30	b
31	b
32	a
33	b
34	a
35	a
36	b
37	a
38	b
39	a
40	B

Вариант 3

Лексико-грамматический тест

I. Заполните пропуски, выбрав верное слово:

by invitation only; Could you please let me know; I would also be grateful; It is with great pleasure; It would be beneficial; Kind regards; please see attachment; to get to know;

Dear Ms Smith,

_____ (1) that we invite you to take part in the tenth International Forum for Energy to discuss the image of the energy industry. This three-day event will be taking place at the International Hotel in Dubai from May 5th-8th of this year (_____ (2) for more details).

Participation in this forum is _____ (3) and the main topic will be public relations regarding the image of the energy industry as a whole, and how this image affects our business. Jane Hall, the CEO of ELEC, will be giving a talk on how ELEC is approaching the subject of public

relations and the lessons we can learn from this experience. There will also be an opportunity _____ (4) other delegates.

_____ (5) if you wish to attend this seminar by sending me an email?

_____ (6) if you could inform me about any other issues you may wish to raise during these three days. There will be an open forum on Thursday evening, May 6th, in which delegates can discuss topics which they feel are important for the industry.

_____ (7), however, if delegates informed me about what they wish to discuss beforehand so that we can draw up a relevant agenda for the evening. I look forward to hearing from you.

_____ (8),

Abdullah Al-Naimi

("English for the Energy Industry", Simon Campbell)

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It would be dangerous to

A switch off the power when input A is connected.

B connect input B with the power off.

C connect input C with the power on.

10.

... See enclosed brochure for details and levels of compensation.

A You should write to us for details about compensation.

B Details about compensation are given in a separate document.

C You will find more information on compensation on the next page.

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30. The Nobel Prize takes its name from its founder, the Swedish chemist and engineer Alfred Nobel who was the ... of dynamite.
a) invent b) inventor c) invention

IV. Прочтите текст:

A bag full of sunshine

If you live in a remote area, or in a poor country, obtaining electricity can be a problem.

The idea, dubbed portable light, combines solar cells with light- emitting diodes attached to the surface of a fabric that can be made into bags, and thus carried around during daylight hours. In sunlight the cells generate electricity that is stored in batteries stitched into the material. When it gets dark the batteries power light- emitting diodes that are also sewn onto the cloth.

The solar cells themselves are made from a substance called copper indium gallium diselenide. This is not quite as good at capturing sunlight as silicon, but it is less rigid and easier to work with. A working cell can be made by spreading a thin layer of the stuff on another material, such as a sheet of plastic. The result is flexible and robust.

Storing the electricity generated by the solar cells involves small batteries that are also woven into the fabric, along with plastic- coated wire connectors.

Rechargeable batteries can store more energy per unit of weight than other types, and do not lose their charge too rapidly if they go unused for long periods.

So the engineers have created a device that stashes away enough electricity to power the light- emitting diodes for ten hours after three hours in full sunlight.

Unlike conventional light sources the fabric can be spread out to provide background lighting for an entire room, to produce light for larger meetings or to power mobile phones.

(From the Economist, 2007)

Укажите:

- a) утверждение соответствует тексту;
b) утверждение не соответствует тексту.

31. Obtaining electricity is not a problem in a poor country.
32. To obtain electricity solar cells can be attached to the surface of a bag.
33. In sunlight the cells can generate electricity.
34. The batteries don't power light- emitting diodes in darkness.
35. Rechargeable batteries can store less energy than other types.
36. Small batteries don't store electricity generated by the solar cells.
37. The substance the solar cells are made of is easy to work with
38. This device can stash away electricity for less than two hours.
39. The fabric with solar cells can power mobile phones.

V. Выберите верный комментарий

40.

Inter-Office Memo

From: Philip Jones
To: Mike Williams
Subject: Finance meeting, 10 a.m., Friday June 8

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- C Can you make the meeting on Friday morning shorter?

Ключи для варианта 3

№ вопроса	Ответ
1	It is with great pleasure
2	please see attachment
3	by invitation only
4	to get to know
5	Could you please let me know
6	I would also be grateful
7	It would be beneficial
8	Kind regards
9	B
10	B
11	d
12	b
13	c
14	a
15	b
16	c
17	a
18	a
19	d
20	b
21	c
22	c
23	b
24	b
25	b
26	c
27	c
28	c
29	c
30	b
31	b
32	a
33	a

34	b
35	b
36	b
37	a
38	b
39	a
40	B

Критерии и шкала оценки:

- критерии оценивания – правильные ответы на поставленные вопросы;
- показатель оценивания – процент верных ответов на вопросы;
- шкала оценивания (оценка) – выделено 4 уровня оценивания компетенций:
высокий (отлично) – более 80% правильных ответов;
достаточный (хорошо) – от 60 до 80 % правильных ответов;
пороговый (удовлетворительно) – от 50 до 60% правильных ответов;
критический (неудовлетворительно) – менее 50% правильных ответов.

4.2. Вопросы к экзамену

Индекс компетенции	Формулировка темы
УК-4, УК-5	1. Достижения в области электроэнергетики и электротехники. Technology in use. Technical functions and application. Technical advantages. Progress updates. Inventions.
УК-4, УК-5	2. Международное сотрудничество в профессиональной и научной сферах. Теория и практика. Tests and experiments. Views on predictions and theories. Expectations and results. Conferences. Presentations. Scientific discussion. Scientific papers.
УК-4, УК-5	3. Сфера научных интересов магистранта. Выдающиеся ученые в сфере научных исследований магистранта. Electricity. Engineering. Electric motors. Power generation. Power plants.
УК-4, УК-5	4. Осуществление профессиональной и научной деятельности. Careers in engineering. Energy business. Fuels and energy sources. Energy markets. Residential, business, industrial customers. Energy companies.
УК-4, УК-5	5. Окружающая среда. Environmental issues. Waste disposal. Regulations and standards. Instructions and notices. Safety and security issues. Monitoring and control. Measurable parameters. Readings and trends. Figures and graphs.

Критерии и шкала оценки:

- критерии оценивания – правильные ответы на поставленные вопросы;
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высокий (отлично) – более 80% правильных ответов;
достаточный (хорошо) – от 60 до 80 % правильных ответов;
пороговый (удовлетворительно) – от 50 до 60% правильных ответов;
критический (неудовлетворительно) – менее 50% правильных ответов.

Результат экзамена	Уровень освоения компетенции	Критерии оценивания
Оценка «отлично»	Высокий уровень	Оценка «отлично» выставляется магистранту, проявившему глубокие знания программного материала, обнаружившему способности в понимании, изложении и практическом использовании материала.
Оценка «хорошо»	Достаточный уровень	Оценка «хорошо» выставляется магистранту, проявившему полное знание программного материала, обнаружившему стабильный характер знаний и умений и способность к их самостоятельному применению в ходе практической деятельности.
Оценка «удовлетворительно»	Пороговый уровень	Оценка «удовлетворительно» выставляется магистранту, проявившему знания основного программного материала в объеме, необходимом для усвоения программы магистратуры по данному направлению, допустившему неточности и/или не принципиальные ошибки в ответе на экзамене, но обладающему необходимыми знаниями и умениями для их устранения при корректировке со стороны экзаменатора.
Оценка «неудовлетворительно»	Критический уровень	Оценка «неудовлетворительно» выставляется магистранту, обнаружившему существенные пробелы в знании основного программного материала, допустившему принципиальные ошибки, которые не позволяют ему приступить к усвоению программы магистратуры по данному направлению.

4.3. Содержание экзамена

1. Письменный перевод с иностранного языка на русский язык текста по одной из изученных тем (примерно 1500 печатных знаков). Время – 60 минут.
2. Чтение и пересказ на иностранном языке текста по одной из изученных тем (объем примерно 1 страница). Время на подготовку – 15-20 минут.
3. Монолог и участие в беседе по одной из изученных тем.

4.4. Материалы к экзамену (тексты)

TEXT 1

FOSSIL FUEL POWER PLANTS

Steam turbine power plants can use coal, oil, natural gas, or just about any combustible material as the fuel resource. However, each fuel type requires a unique set of accessory equipment to inject fuel into the boiler, control the burning process, vent and exhaust gases, capture unwanted byproducts, and so on.

Some fossil fuel power plants can switch fuels. For example, it is common for an oil plant to convert to natural gas when gas is less expensive than oil. Most of the time, it is not practical to convert a coal burning power plant to oil or gas unless it has been designed for conversion. The processes are usually different enough so that switching will not be cost effective.

Coal is burned in two different ways in coal fired plants. First, in traditional coal fired plants, the coal is placed on metal conveyor belts inside the boiler chamber. The coal is burned while on the belt as the belt slowly traverses the bottom of the boiler. Ash falls through the chain conveyor belt and is collected below where it is sometimes sold as a useful by-product for other industries.

In pulverized coal power plants, the coal is crushed into a fine powder and injected into the furnace where it is burned similar to a gas. Pulverized coal is mixed with air and ignited in the furnace. Combustion by-products include solid residue (ash) that is collected at the bottom of the furnace and gases that include fine ash, NO_2 , CO , and SO_2 , which are emitted into the atmosphere through the stack.

Depending on local environmental regulations, scrubber and baghouse equipment may be required and installed to collect most of these by-products before they reach the atmosphere.

Scrubbers are used to collect the undesirable gases to improve the quality of the stack output emissions. Baghouses are commonly used to help collect fly ash.

Some of the drawbacks that could be encountered with coal fired steam generating power plants are:

- Environmental concerns from burning coal (i.e., acid rain)
- Transportation issues regarding rail systems for coal delivery
- Length of transmission lines to remote power plant locations

Figure 2-10 shows the layout of a typical steam power plant. Notice the steam line used to transfer superheated steam from the boiler to the turbine and then through the condenser where it is returned to a water state and recycled. Notice the steam turbine connected to the generator. The turbine speed is controlled by the amount of steam applied in order to control frequency. When load picks up on the electrical system, the turbine shaft speed slows down and more steam is then placed on the turbine blades to maintain frequency. Notice how coal is delivered to the boiler and burned. Exhaust is vented through the stack. Scrubbers and bags remove the by-products before they enter the atmosphere. Water from a nearby reservoir is pumped to the condenser where it is used to convert steam back into water and recycled.

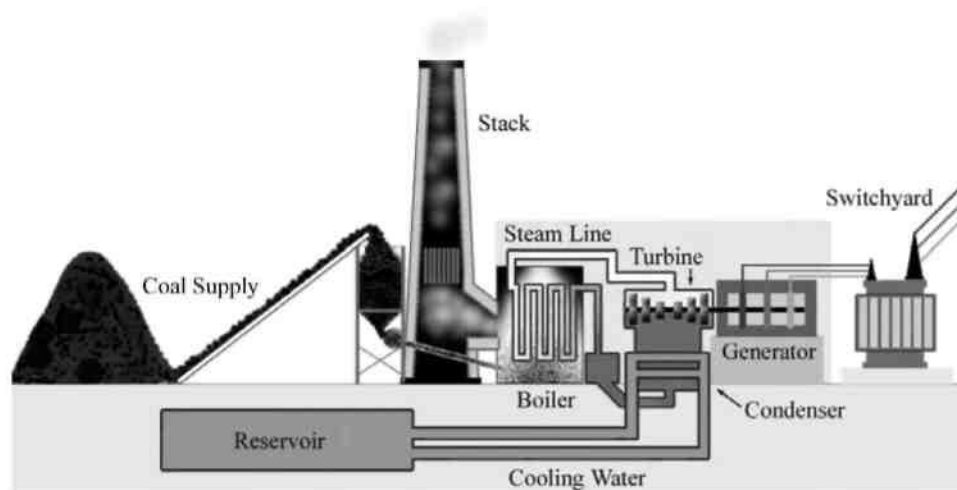


Figure 2-10. Steam power plant.

(«Electric Power System Basics» Steven W. Blume)

HISTORY OF ELECTRIC POWER

Benjamin Franklin is known for his discovery of electricity. Born in 1706, he began studying electricity in the early 1750s. His observations, including his kite experiment, verified the nature of electricity. He knew that lightning was very powerful and dangerous. The famous 1752 kite experiment featured a pointed metal piece on the top of the kite and a metal key at the base end of the kite string. The string went through the key and attached to a Leyden jar. (A Leyden jar consists of two metal conductors separated by an insulator.) He held the string with a short section of dry silk as insulation from the lightning energy. He then flew the kite in a thunderstorm. He first noticed that some loose strands of the hemp string stood erect, avoiding one another. (Hemp is a perennial American plant used in rope making by the Indians.) He proceeded to touch the key with his knuckle and received a small electrical shock.

Between 1750 and 1850 there were many great discoveries in the principles of electricity and magnetism by Volta, Coulomb, Gauss, Henry, Faraday, and others. It was found that electric current produces a magnetic field and that a moving magnetic field produces electricity in a wire. This led to many inventions such as the battery (1800), generator (1831), electric motor (1831), telegraph (1837), and telephone (1876), plus many other intriguing inventions.

In 1879, Thomas Edison invented a more efficient lightbulb, similar to those in use today. In 1882, he placed into operation the historic Pearl Street steam-electric plant and the first direct current (dc) distribution system in New York City, powering over 10,000 electric lightbulbs. By the late 1880s, power demand for electric motors required 24-hour service and dramatically raised electricity demand for transportation and other industry needs. By the end of the 1880s, small, centralized areas of electrical power distribution were sprinkled across U.S. cities. Each distribution center was limited to a service range of a few blocks because of the inefficiencies of transmitting direct current. Voltage could not be increased or decreased using direct current systems, and a way to transport power longer distances was needed.

To solve the problem of transporting electrical power over long distances, George Westinghouse developed a device called the “transformer.” The transformer allowed electrical energy to be transported over long distances efficiently. This made it possible to supply electric power to homes and businesses located far from the electric generating plants. The application of transformers required the distribution system to be of the alternating current (ac) type as opposed to direct current (dc) type.

The development of the Niagara Falls hydroelectric power plant in 1896 initiated the practice of placing electric power generating plants far from consumption areas. The Niagara plant provided electricity to Buffalo, New York, more than 20 miles away. With the Niagara plant, Westinghouse convincingly demonstrated the superiority of transporting electric power over long distances using alternating current (ac). Niagara was the first large power system to supply multiple large consumers with only one power line.

Since the early 1900s alternating current power systems began appearing throughout the United States. These power systems became interconnected to form what we know today as the three major power grids in the United States and Canada.

(«Electric Power System Basics» Steven W. Blume)

TEXT 3

HOW TO MAKE TESTS ON INSTALLATIONS

a) Insulation tests to earth.

Disconnect the supply by opening the main switch and withdrawing the main fuses.

Insert all fuses at the distribution board (see Fig. 22).

Insert all lamps.

Close all single-pole switches.

Join together the two contacts on the installation side on the main switch, and connect them to one terminal of the Insulation Tester used.

Connect the other terminal of the Tester to the conduit in which the wiring is run or, if lead-covered cable is used, to the lead sheathing. A second connection should also be made to the consumer's main earth. This second connection is, however, unnecessary if the continuity and earthing of the conduit had been previously tested.

Turn the handle of the Tester at about 160 r.p.m. and take a reading.

In case the result of the test is considered satisfactory the installation is in proper order so far as resistance to earth is concerned.

If, however, the values obtained are not sufficiently high, withdraw all fuses at the distribution fuse board and test again. This test should include only the portion of the installation between the main switch and the busbars of the fuse board.

If the fault is not detected, one should proceed to the distribution fuse board and test each branch circuit in turn till the faulty circuit or circuits are discovered. These should be subjected to further tests till the actual fault is detected.

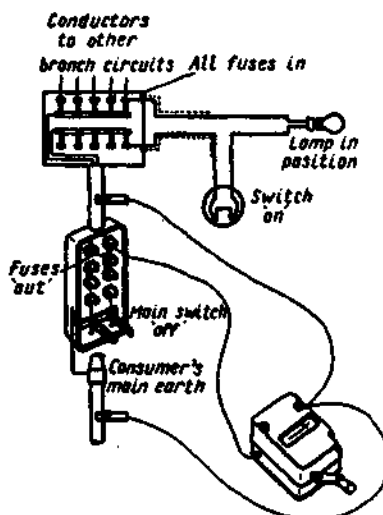


Fig.22. Insulation test to earth

b) Insulation test between conductors.

Remove all lamps.

The main switch should be opened, all fuses inserted at the distribution board, and all single-pole switches in the closed or "on" position.

Connect one terminal of the Insulation Tester to fuse contact and the other to another contact and make a test.

Two readings should be taken on an insulation containing two-way switches, one with both switches in the "on" position and the other with both switches in the "off" position.

If the result of the test between conductors is also satisfactory, no further insulation tests are necessary and the insulation may be considered to be in order.

If, however, the results of the tests are unsatisfactory, proceed to the distribution board, withdraw all fuses and test each branch circuit individually between conductors until the faulty circuit or circuits are located.

(«Английский язык для энергетических специальностей», А.Л. Луговая)

TEXT 4

HYDROELECTRIC POWER PLANTS

Hydroelectric power plants capture the energy of moving water. There are multiple ways hydro energy can be extracted. Falling water such as in a penstock, flume, or waterwheel can be used to drive a hydro turbine. Hydro energy can be extracted from water flowing at the lower section of dams, where the pressure forces water to flow. Hydroelectric power generation is efficient, cost-effective, and

environmentally cooperative. Hydro power production is considered to be a renewable energy source because the water cycle is continuous and constantly recharged.

Water flows much slower through a hydro turbine than does steam through a high-pressure steam turbine. Therefore, several rotor magnetic poles are used to reduce the rotational speed requirement of the hydro turbine shaft.

Hydro units have a number of excellent advantages. The hydro unit can be started very quickly and brought up to full load in a matter of minutes. In most cases, little or no start-up power is required. A hydro plant is almost by definition a *black start* unit. Black start means that electrical power is not needed first in order to start a hydro power plant.

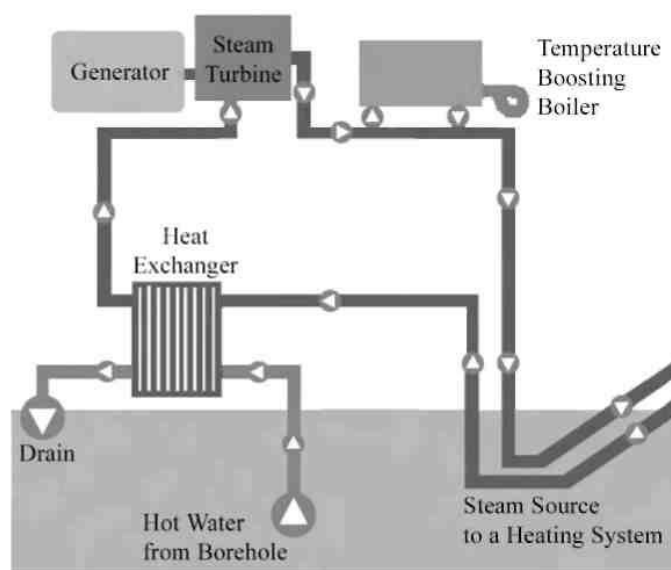


Figure 2-15. A geothermal power plant and schematic. *Source:* Fotosearch.

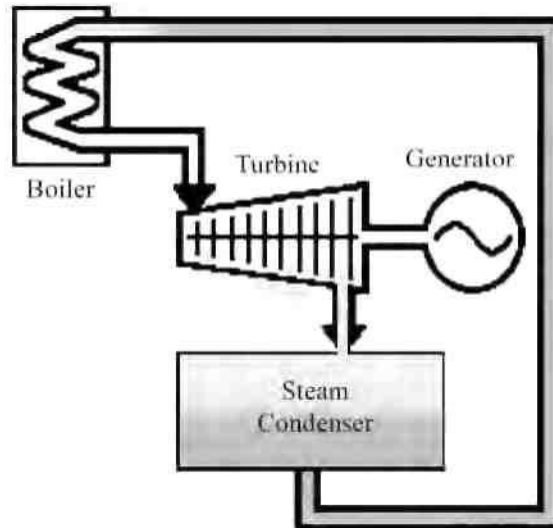
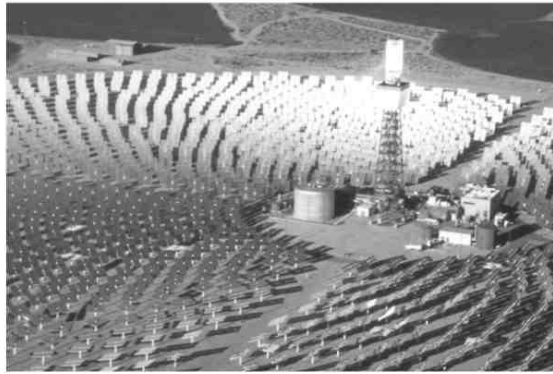


Figure 2-16. Reflective solar power plant and schematic. *Source:* Fotosearch.

Hydro plants have a relatively long life; 50–60 year life spans are common. Some hydroelectric power plants along the Truckee River in California have been in operation for over 100 years. Figure 2-17 shows a typical hydroelectric power plant.

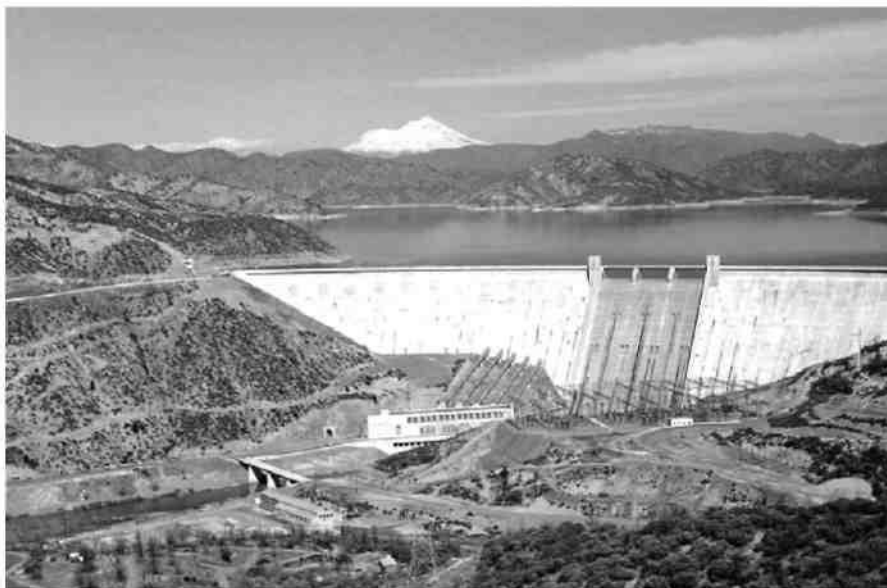


Figure 2-17. Hydroelectric power plant. *Source:* Photovault.

(«Electric Power System Basics» Steven W. Blume)

STEAM TURBINE POWER PLANTS

High-pressure and high-temperature steam is created in a boiler, furnace, or heat exchanger and moved through a *steam turbine generator* (STG) that converts the steam's energy into rotational energy that turns the generator shaft. The steam turbine's rotating shaft is directly coupled to the generator rotor. The STG shaft speed is tightly controlled for it is directly related to the frequency of the electrical power being produced.

High-temperature, high-pressure steam is used to turn steam turbines that ultimately turn the generator rotors. Temperatures on the order of 1,000°F and pressures on the order of 2,000 pounds per square inch (psi) are commonly used in large steam power plants. Steam at this pressure and temperature is called *superheated steam*, sometimes referred to as *dry steam*.

The steam's pressure and temperature drop significantly after it is applied across the *first stage* turbine blades. Turbine blades make up the fan-shaped rotor to which steam is directed, thus turning the shaft. The superheated steam is reduced in pressure and temperature after it passes through the turbine. The reduced steam can be routed through a *second stage* set of turbine blades where additional steam energy is transferred to the turbine shaft. This second stage equipment is significantly larger than the first stage to allow for additional expansion and energy transformation. In some power plants, the steam following the first stage is redirected back to the boiler where it is reheated and then sent back to the second turbine stage for a more efficient energy transformation.

Once the energy of the steam has been transferred to the turbine shaft, the low-temperature and low-pressure steam has basically exhausted its energy and must be fully *condensed* back to water before it can be recycled. The condensing process of steam back to water is accomplished by a *condenser* and *cooling tower(s)*. Once the used steam is condensed back to warm water, the *boiler feed pump* (BFP) pumps the warm water back to the boiler where it is recycled. This is a closed-loop process. Some water has to be added in the process due to small leaks and evaporation.

The condenser takes cold water from nearby lakes, ponds, rivers, oceans, deep wells, cooling towers, and other water sources and pumps it through pipes in the condenser. The used steam passes through the relatively cold water pipes and causes dripping to occur. The droplets are collected at the base of the condenser (the well) and pumped back to the boiler by the BFP.

The overall steam generation plant efficiency in converting fuel heat energy into mechanical rotation energy and then into electrical energy ranges from 25 to 35%. Although it is a relatively low-efficiency system, steam turbine generation is very reliable and is commonly used as base load generation units in large electric power systems. Most of the inefficiency in steam turbine generation plants comes from the loss of heat into the atmosphere in the boiler process.

(«Electric Power System Basics» Steven W. Blume)

TEXT 6

THE ELECTRIC FIELD

Also called the electrostatic field, the electric field is not as commonly known per se as the magnetic field. In the same way that current is connected to the magnetic field, voltage is connected to the electric field. That leads to a good rule of thumb to remember: Current is magnetic and voltage is electric.

The electric field comes from electric charges, both positive and negative. In a way that is analogous to the way like poles on magnets repel and opposite poles attract, like charges repel and opposite charges attract. Any molecule or atom can be neutral (no net charge), positively charged, or negatively charged. The accumulation of these charges is what is known as voltage. One way to think of it is that the charges are the voltage making the electric field, and movement of those charges is called current and creates the magnetic field.

Similar to the way an inductor is a way of concentrating a magnetic field, a capacitor is a way of concentrating an electric field. Capacitors are made by two collectors or plates separated by a material

that will not conduct electricity, also known as a dielectric. The symbol of a capacitor mimics the construction, as shown in Figure 2.45.

Because of the dielectric, current or actual charges cannot flow or move across the capacitor, and all the charges build up on one side of the cap, kind of like a 50-car pileup on the freeway, as shown in Figure 2.46.



FIGURE 2.45
Capacitor symbol.

As the charges pile up on one side, the electrostatic field builds up, causing all the like charges on the other side of the cap to go rushing away (remember how like charges repel). Once it all comes to rest, there is an equal number of opposite charges on the other side of the cap. In this way the capacitor stores a charge of voltage on the plates of the capacitor.

How much charge a cap can store in an electric field is a function of the area of the plates. The amount of voltage it can store is dependent on the strength of the dielectric. If you exceed the capability of the insulation, the dielectric will break down and a charge will cross the gap. The same thing happens on a stormy day. During a thunderstorm charges build up in the clouds and the ground in the same way they do on either side of a capacitor. A lightning strike is a large-scale version of what happens when the insulation or dielectric in a capacitor breaks down.

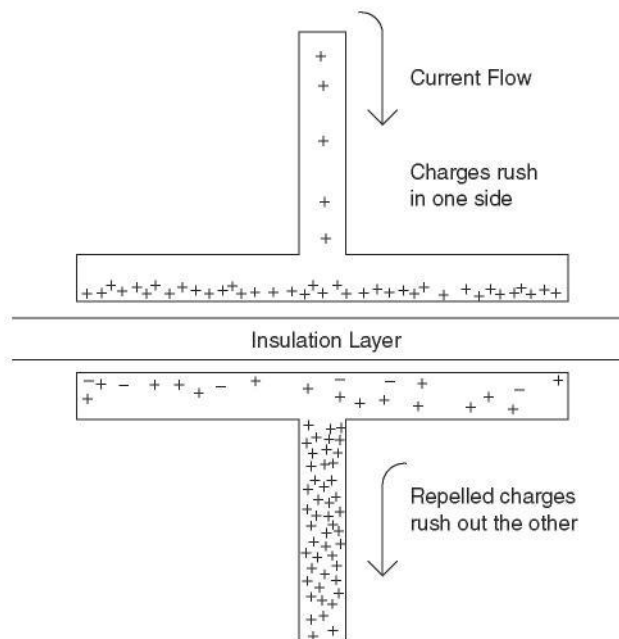


FIGURE 2.46
Behavior of charges in a capacitor.

(«Electric Power System Basics» Steven W. Blume)

TEXT 7

DC MOTORS

My eldest son was elated when he got a Lego Mindstorms kit for Christmas when he was about 8 years old. For those who don't know, this is a ready-made robot kit based on—you guessed it—Legos. My wife claims I was much more excited than our son was. I beg to differ, but we won't go into that now. The whole point of a robot is that it moves (a fact that my son wanted to exploit to make a robot to clean his room). The Lego kit uses little DC permanent magnet motors with gears and such to get along.

Since this type of motor is so popular, a little discussion about DC permanent magnet motors and how to control them seems prudent.

The DC permanent magnet (PM) brush motor is probably the easiest motor to understand. It consists of just a few parts: an armature, some magnets, a case, wires, and brushes. I remember as a kid making a motor out of a couple of nails, a dowel, and some wire. It looked something like what's in Figure 4.31.

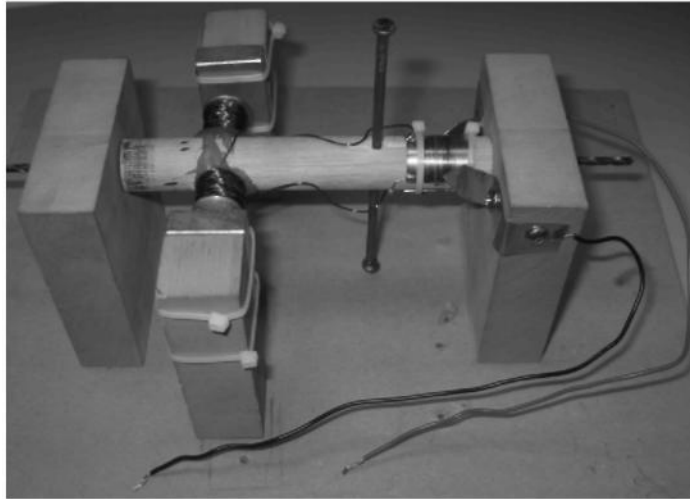


FIGURE 4.31
A home-built motor.

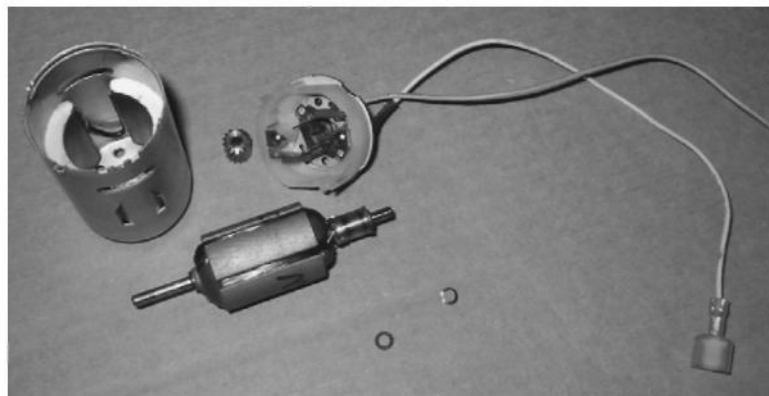


FIGURE 4.32
A motor taken apart.

You can make a motor by winding the wire onto the armature in a loop. The ends of the wire terminate on segments that the brushes rub on, as shown in Figure 4.32.

Permanent magnets are attached to the case in such a way as to surround the armature. The armature is supported in the case by bearings or bushings so that it can rotate freely. At its most basic, the coil of wire on the armature is nothing more than an inductor. As we learned earlier, an inductor develops a magnetic field when you pass current through it. This magnetic field is just like the one present around the permanent magnet. By controlling when the magnetic field is present around the armature, you cause the field around the wires to push or pull against the field around the magnet. The current to the armature is switched on and off (which turns the magnetic field on and off) in a sequence that causes the armature to turn. This is called commutation. In the DC PM brush motor, the brushes are the method of commutation. They switch the current through various sections of the armature as it turns.

A DC PM motor has two inputs and two outputs. You put voltage and current in and get speed and torque out. One nice thing is that the speed is proportional to the voltage and the torque is proportional to the current. Motors are devices in which the physical equivalents of electric components are not only similar in nature but are actually linked in performance. Think of it this way: Voltage and current together equal power. Speed and torque together also equal power. So, in a motor, you put

electrical power in and get mechanical power out. That actually makes sense, doesn't it? The equivalent circuit looks like the one shown in Figure 4.33.

What do you think the resistor is doing in this circuit? Have you ever noticed a motor getting warm when it operates? This heating comes from the resistive component in the motor. Any wire short of a superconductor has resistance. The armature, being made out of wire, also has resistance. Current flowing through a resistor will create a voltage drop across said resistor, and power across that resistor turns into heat. Ohm's Law still works.

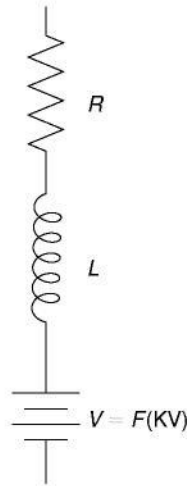


FIGURE 4.33
Inside a DC PM motor.

The inductor creates the magnetic field that turns the armature. The battery represents what is called the back EMF, or electromotive force. If you were to spin the shaft of the motor with nothing but a voltmeter hooked up to it, you would see a voltage appear on this meter that is proportional to the speed at which you spin the shaft. When you apply a voltage to the motor, the shaft will spin at a speed in the same proportion. However, not all the voltage you apply to the leads makes it to this point in the motor. Some of it is lost across the resistor.

(«Electric Power System Basics» Steven W. Blume)

TEXT 8

THE MAGNETIC FIELD

This is the most well-known of the two fields that we are going to discuss. Who hasn't experienced the force of a magnet sticking a note to the fridge or felt the power of two repelling magnets? Back in the 1820s, a man by the name of Hans Oersted noticed his compass read strangely every time he switched on a current in a wire. Eventually it was discovered that a moving electron (such as the current in a wire) creates a magnetic field perpendicular to the direction of electron movement, as shown in Figure 2.39.

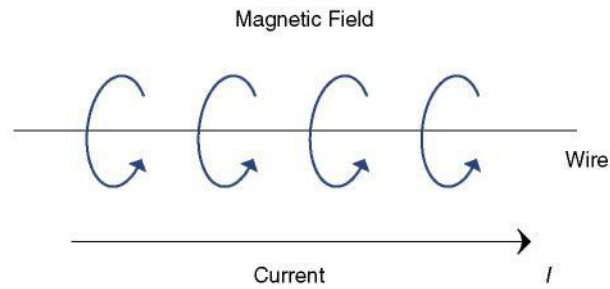


FIGURE 2.39
Magnetic field caused by current in a wire.

This field is identical to the field surrounding a permanent magnet. In fact, if you coil the wire like what's shown in Figure 2.40, the magnetic field lines align and reinforce each other, making it even more like a permanent magnet.

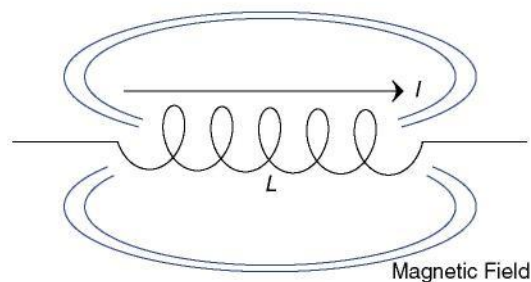


FIGURE 2.40
Coils change direction of field and reinforce.

Electromagnets, as they are called, are pretty cool since they can be switched on and off, unlike permanent magnets. Another important fact is that not only does a current moving through a wire create a magnetic field, but the opposite is also true. A changing magnetic field can create or induce a current in a wire. A coil of wire is known as an inductor for this reason. Energy is stored in an inductor as a magnetic field. It is like a rubber band that is stretched as you apply current. When the current is shut off it snaps back, and energy is given up as the magnetic field collapses (it is changing as it goes away). This collapse induces a current in the wire. Consider the circuit shown in Figure 2.41.

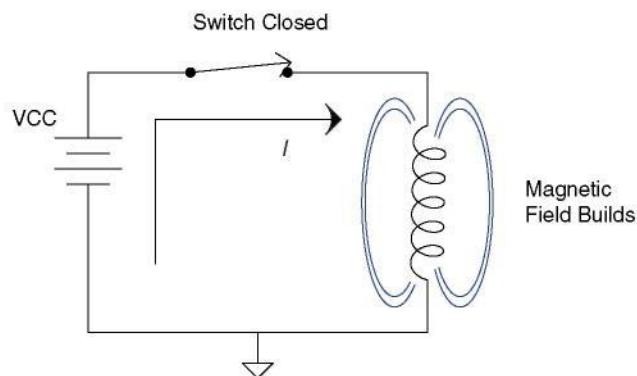


FIGURE 2.41
Building a magnetic field resists current change.

When the switch is closed, current flows and a magnetic field is created. It is the creation of the magnetic field (stretching the rubber band, so to speak) that causes the inductor to “resist” the change in current, as we learned it does earlier. The flip side of that also happens. If we open the switch, the change in the field as it collapses would like to keep the current flowing in the inductor—see Figure 2.42.

If there is no place for this current to go, the voltage across the inductor will increase instantaneously and then dissipate as the induced current drops off with the drop of the magnetic field.

Take a look at the graph shown in Figure 2.43 of the current and voltage changing in this inductor circuit as the switch opens and closes.

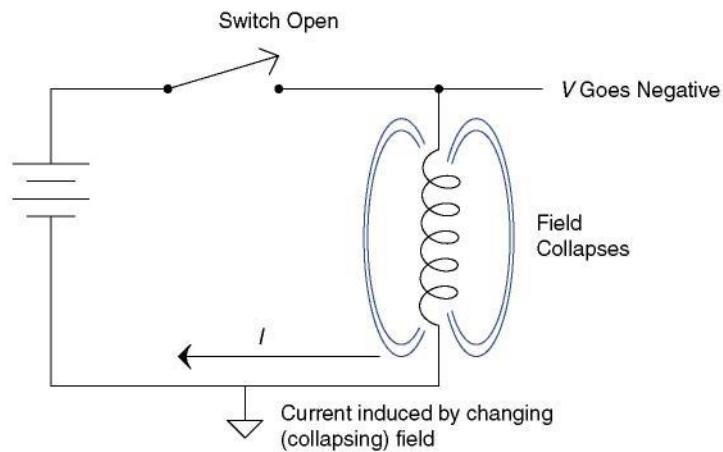


FIGURE 2.42
Collapsing magnetic field generates a current.

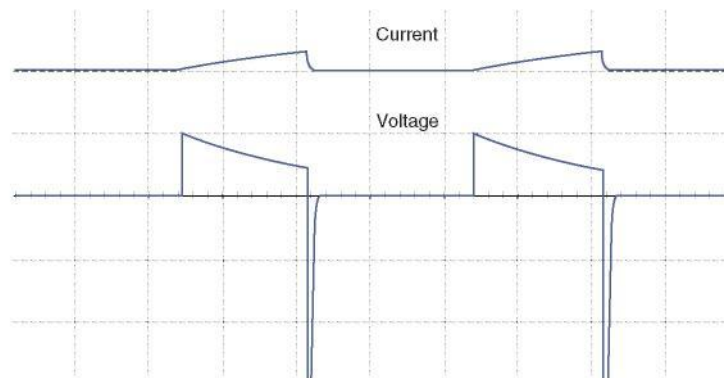


FIGURE 2.43
Voltage and current changes as an inductor is switched in and out of circuit.

Induction is also the fundamental principle that a transformer uses. The magnetic field—as it is created on one side of the transformer as is shown in Figure 2.44— induces a current on the other side of the transformer. When the field reduces, and it switches direction, a corresponding current is induced at the output.

The ratio of turns on each side of the transformer controls the ratio of voltage from input to output. A 10:1 ratio will take 120 V on one side and create 12 V on the other. Note also that though voltage goes down, current goes up, making a transformer kind of like a gear train or lever in the mechanical world. Power into it is the same as power out of it (minus losses, of course). Voltage times current in equals voltage times current out. This is akin to the rule that force times distance on one side of a lever equals force times distance on the other side.

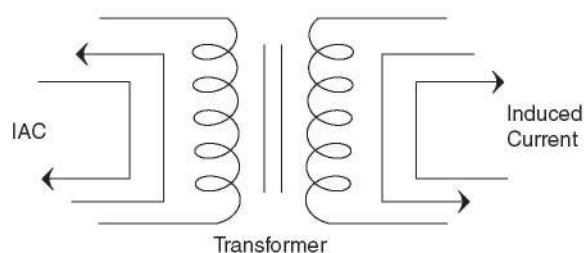


FIGURE 2.44
A transformer uses changing current on the input to induce current on the output.

The fundamental component of a transformer is an inductor. An inductor is simply a coil of wire, as we learned earlier. The number of turns of wire controls the concentration of the magnetic field. The core of the inductor also has the effect of concentrating the field. The material in the core can become saturated, meaning that it cannot concentrate the field any more tightly than it has.

The important things to remember are that current creates a magnetic field, and a changing magnetic field creates a current. The changing field can be externally applied from a moving magnet, the input side of a transformer, or from the collapse of the field just created by the current. Current and magnetic fields are closely connected.

(«Electric Power System Basics» Steven W. Blume)

TEXT 9

THE ELECTRIC MOTOR

In an electric motor an electric current and magnetic field produce a turning movement. This can drive all sorts of machines, from wrist-watches to trains. The motor shown in Fig. 1 is for a washing machine. It is a universal motor, which can run on direct current or alternating current.

An electric current running through a wire produces a magnetic field around the wire. If an electric current flows around a loop of wire with a bar of iron through it, the iron becomes magnetized. It is called an electromagnet; one end becomes a north pole and the other a south pole, depending on which way the current is flowing around the loop.

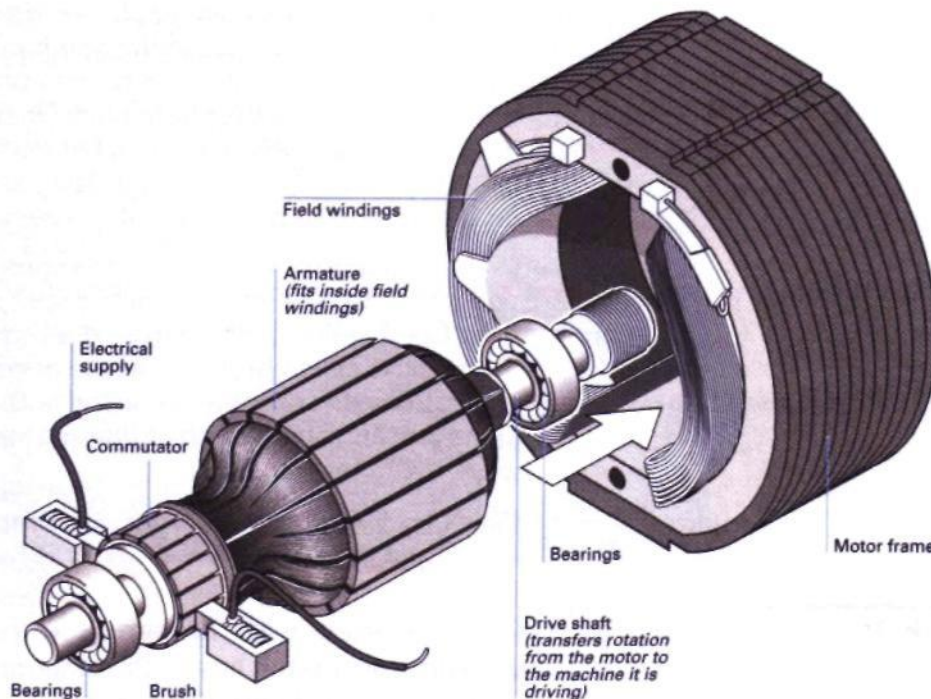


Fig. 1

If you put two magnets close together, like poles - for example, two north poles - repel each other, and unlike poles attract each other.

In a simple electric motor, like the one shown in Fig. 2, a piece of iron with loops of wire round it, called an armature, is placed between the north and south poles of a stationary magnet, known as the field magnet. When electricity flows around the armature wire, the iron becomes an electromagnet.

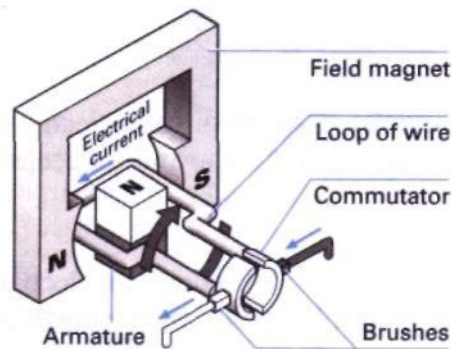


Fig. 2

The attraction and repulsion between the poles of this armature magnet and the poles of the field magnet make the armature turn. As a result, its north pole is close to the south pole of the field magnet. Then the current is reversed so the north pole of the armature magnet becomes the south pole. Once again, the attraction and repulsion between it and the field magnet make it turn. The armature continues turning as long as the direction of the current, and therefore its magnetic poles, keeps being reversed.

To reverse the direction of the current, the ends of the armature wire are connected to different halves of a split ring called a commutator. Current flows to and from the commutator through small carbon blocks called brushes. As the armature turns, first one half of the commutator comes into contact with the brush delivering the current, and then the other, so the direction of the current keeps being reversed.

(Source: Adapted from “Inside out: Electric Motor”, Education Guardian)

TEXT 10

THE WASHING MACHINE

Many items found in the home contain control systems. The washing machine is one of the most complex.

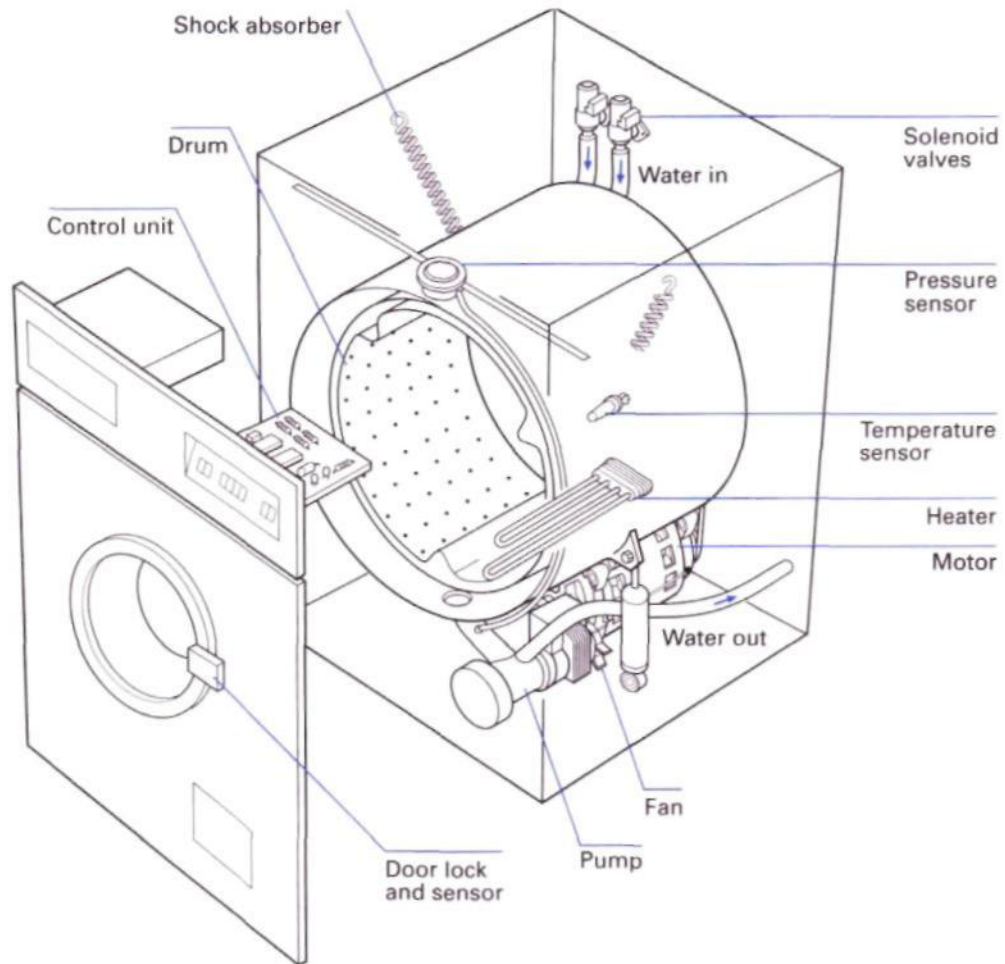


Fig.1 Cross- section through a washing machine

The control system of a modern washing machine has to take into account several different factors. These are door position, water level, water temperature, wash and spin times, and drum speeds. Most of them are decided when you select which washing program to use.

Fig. 3 shows a block diagram of a washing machine control system. You can see that this is quite a complex closed loop system using feedback to keep a check on water level, water temperature, and drum speeds.

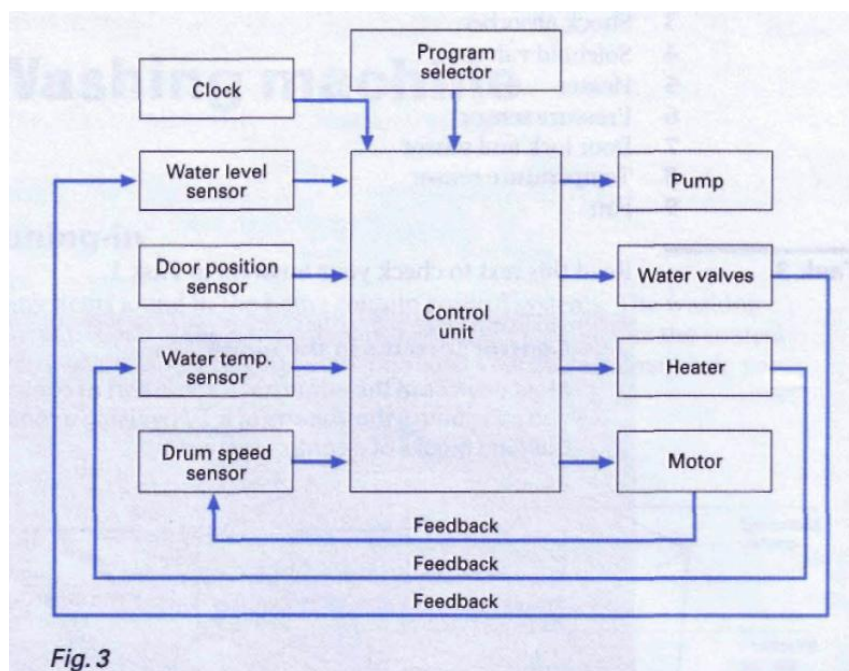


Fig. 3

The control unit is the heart of the system. It receives and sends out signals which control all the activities of the machine. It is also capable of diagnosing faults which may occur, stopping the program, and informing the service engineer what is wrong. It is a small, dedicated computer which, like other computers, uses the language of logic.

Door position

The machine will not start any program unless the door is fully closed and locked. When the door is closed, it completes an electrical circuit which heats up a heat-sensitive pellet. This expands as it gets hot, pushing a mechanical lock into place and closing a switch. The switch signals the control unit that the door is closed and locked. Only when it has received this signal will the control unit start the wash program.

Water level

When a wash program first starts it has to open the valves which allow the water in. There are usually two of these valves, one for hot water and one for cold. Each must be controlled separately depending on the water temperature needed for that program. The valves are solenoid operated, i.e. they are opened and closed electrically.

The rising water level is checked by the water level sensor. This is a pressure sensor. The pressure of the air in the plastic tube rises as it is compressed by the rising water. The pressure sensor keeps the control unit informed as to the pressure reached and the control unit uses the information to decide when to close the water inlet valves.

Water temperature

The temperature sensor, a type of thermometer which fits inside the washer drum, measures the water temperature and signals it to the control unit. The control unit compares it with the temperature needed for the program being used. If the water temperature is too low, the control unit will switch on the heater. The temperature sensor continues to check the temperature and keep the control unit informed. Once the correct temperature is reached, the control unit switches off the heater and moves on to the next stage of the program.

Clock

The control unit includes a memory which tells it how long each stage of a program should last. The times may be different for each program. The electronic clock built into the control unit keeps the memory of the control unit informed so that each stage of each program is timed correctly.

Drum speed

During the washing and spinning cycles of the program, the drum has to spin at various speeds. Most machines use three different speeds: 53 rpm for washing; 83 rpm for distributing the load before spinning; 100 rpm for spinning.

The control unit signals the motor to produce these speeds. The motor starts up slowly, then gradually increases speed. The speed sensor, a tachogenerator, keeps the control unit informed as to the speed that has been reached. The control unit uses the information to control the power to the motor and so controls the speed of the drum at all times.

(Source: P. Fowler and M. Horsley, 'Control systems in the home', CDT: Technology)

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