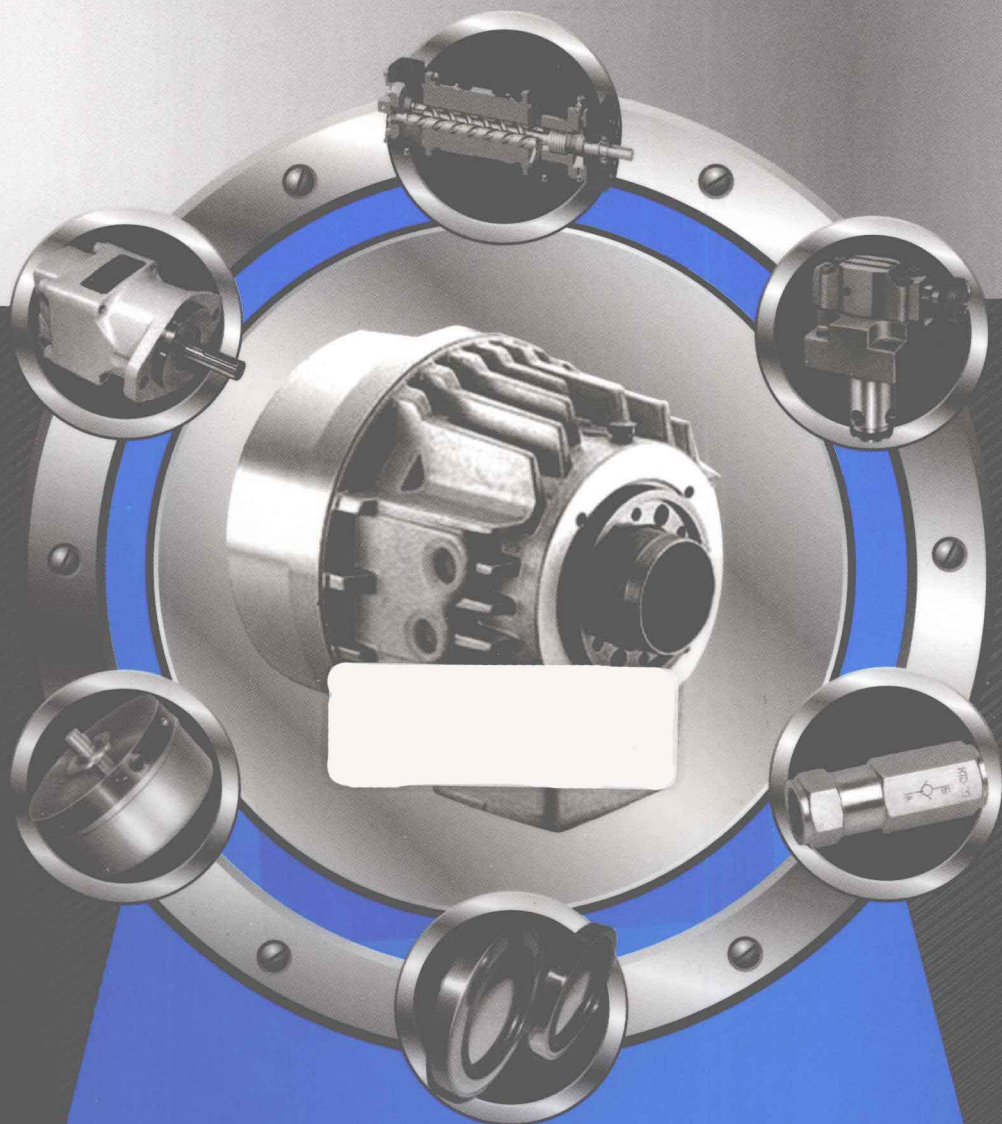


T U J I E Y E Y A Q I D O N G J I S H U Y I N G Y U

图解

液压气动技术英语

杨务滋 王昌平 黄亚光 编著

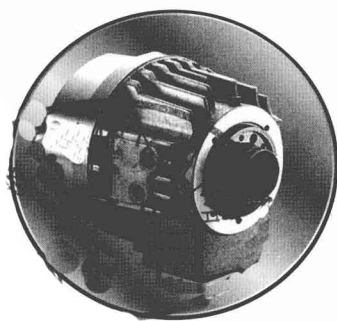


化学工业出版社

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· 北 京 ·

前 言

近年来我国机械行业发展迅速，液压与气动技术在现代国民经济中的应用越来越广泛，其所处的位置越来越重要。采用液压传动的程度已成为衡量一个国家工业水平的重要标志之一，发达国家生产的95%的工程机械、90%的数控加工中心和95%以上的自动化生产线都采用了液压传动技术。随着技术全球化程度的提高及进出口贸易的不断扩大，掌握一定的液压专业英语成为了机械行业从业人员的必备技能，液压与气动专业英语的重要性日益突显。

本书从便于读者阅读和理解出发，采用图文并茂的形式，用中英两种语言对图形进行注解，对液压与气动元件等内容从外观、结构到符号进行图文、英汉同步跟随编写，对液压与气动技术做了新形式的表达，使专业内容更加直观、具体、形象、生动。这种方式可使读者在学会某个名词、动词的英语表达时，进一步巩固、加深对液压与气动本身专业术语的理解。

本书的主要内容分为液压技术、气动技术两大部分。内容选材包括液压与气动技术名词术语，液压与气动工作介质，液压与气动元件，液压与气动回路，液压与气动典型系统。对于已经学过液压与气动专业课程的读者，在重温专业知识的同时达到提高专业英语水平的目的；对于没学过该专业课程的人士，可以起到简单学习专业术语、名称，初步掌握液压与气动专业知识的作用；同时可以作为工科院校机械类师生的教学参考书。

本书由中南大学机电工程学院杨务滋、王昌平、黄亚光编著。杨务滋负责全书的统稿。杨务滋编写了第1章及附录；王昌平编写了第2、4、5、6、8、9章；黄亚光编写了第3、7章。苏永雷、高司霄、殷杰参与了本书的中英文校对，刘宁、郑锦霞、卢丽等参与了本书的文稿录入整理以及部分插图的绘制等工作。

衷心感谢在本书编写过程中各位专家教授和朋友的大力支持与帮助。限于编者水平，书中疏漏之处在所难免，敬请广大读者批评指正。

编著者

目 录

Chapter 1 Basic Terminology in Hydraulic

Transmission 1

- 1.1 Terminology list 1
- 1.2 Short passages for reading 8

Chapter 2 Hydraulic Medium 9

- 2.1 Types of hydraulic fluids 9
- 2.2 The name of the hydraulic oil 10
- 2.3 The viscosity of hydraulic oil 11
- 2.4 The classification of hydraulic fluid
 - contamination 12
 - 2.4.1 Particulate contamination 12
 - 2.4.2 Fluid contamination 13
- 2.5 Reading essay 13

Chapter 3 Hydraulic Units 14

- 3.1 Hydraulic power units—hydraulic pump 14
 - 3.1.1 Gear pump 14
 - 3.1.2 Vane pump 20
 - 3.1.3 Plunger pump 25
 - 3.1.4 Screw pump 34
 - 3.1.5 Short passages for reading 35
- 3.2 Hydraulic control components—hydraulic valve 35
 - 3.2.1 Pressure valve 35
 - 3.2.2 Direction valve 49
 - 3.2.3 Flow valve 65
 - 3.2.4 Modular valve 75
 - 3.2.5 Cartridge valve 83
 - 3.2.6 Proportional valve 88
 - 3.2.7 Short passages for reading 103
- 3.3 Hydraulic actuator—hydraulic cylinder and hydraulic motor 103
 - 3.3.1 Hydraulic cylinder 103
 - 3.3.2 Hydraulic motor 112
 - 3.3.3 Short passages for reading 123
- 3.4 Hydraulic auxiliary component 123
 - 3.4.1 Piping/tubing and connectors 123
 - 3.4.2 Filter 127

- 3.4.3 Accumulator 131
- 3.4.4 Cooling unit 133
- 3.4.5 Fuel tank 135
- 3.4.6 Sealing element 137
- 3.4.7 Heat exchanger 141
- 3.4.8 Pressure gauges and switch of pressure 143
- 3.4.9 Short passages for reading 143

Chapter 4 Basic Hydraulic Circuits 146

- 4.1 Basic hydraulic circuits 146
 - 4.1.1 Pressure control circuits 146
 - 4.1.2 Speed control circuits 160
 - 4.1.3 Directional control circuits 175
- 4.2 Other common circuit 180
 - 4.2.1 Synchronization circuit 180
 - 4.2.2 Sequence action circuit 192
 - 4.2.3 Servo control circuit 197
 - 4.2.4 Reading essay 201

Chapter 5 Typical Hydraulic System Diagrams 203

- 5.1 Typical hydraulic system diagram I 203
 - 5.1.1 Schematic diagram of hydraulic system 203
 - 5.1.2 Reading essay 203
- 5.2 Typical hydraulic system diagram II 206
 - 5.2.1 Schematic diagram of hydraulic system 206
 - 5.2.2 Reading essay 206
- 5.3 Reading essay 211

Chapter 6 Pneumatic Medium 212

- 6.1 Compressed air 212
- 6.2 Read the essay 213

Chapter 7 Pneumatic Components 214

- 7.1 Air supply devices 214
 - 7.1.1 Air compressor 214
 - 7.1.2 Gasholder 216

7.1.3 After cooler	216	第1章 液压气动名词术语	267
7.1.4 Short passages for reading	218	1.1 名词术语列表	267
7.2 Pneumatic control components— pneumatic valves	218	1.2 阅读短文	267
7.2.1 Direction control valves	218	第2章 液压工作介质	268
7.2.2 Pressure control valves	222	2.1 液压介质的分类	268
7.2.3 Flow control valves	225	2.2 液压油品的名称	269
7.2.4 Short passages for reading	226	2.3 液压油的黏度等级	269
7.3 Pneumatic actuators—pneumatic cylinder and pneumatic motor	226	2.4 液压油污染物的类型	270
7.3.1 Pneumatic cylinder	226	2.4.1 固体污染物	270
7.3.2 Pneumatic motor	231	2.4.2 流体污染	271
7.3.3 Short passages for reading	233	2.5 阅读短文	271
7.4 Pneumatic auxiliary components	233	第3章 液压元件	272
7.4.1 Lubrication components	233	3.1 液压动力元件——液压泵	272
7.4.2 Air processing components	237	3.1.1 齿轮泵	272
7.4.3 Mufflers	238	3.1.2 叶片泵	274
7.4.4 Pneumatic sensor	240	3.1.3 柱塞泵	275
7.4.5 Pneumatic amplifier	242	3.1.4 螺杆泵	277
7.4.6 Commutator	243	3.1.5 阅读短文	277
7.4.7 Pipeline system	244	3.2 液压控制元件——液压阀	277
7.4.8 Short passages for reading	244	3.2.1 压力阀	277
7.5 Vacuum components	246	3.2.2 方向阀	279
7.5.1 Vacuum generator	246	3.2.3 流量阀	282
7.5.2 Vacuum cups	247	3.2.4 叠加阀	282
7.5.3 Vacuum valve	249	3.2.5 插装阀	283
7.5.4 Vacuum pressure switch	250	3.2.6 比例阀	283
7.5.5 Short passages for reading	250	3.2.7 阅读短文	285
Chapter 8 Pneumatic Circuits	251	3.3 液压执行元件——液压缸和液压 马达	286
8.1 Basic pneumatic circuits	251	3.3.1 液压缸	286
8.1.1 Pressure regulated circuit	251	3.3.2 液压马达	287
8.1.2 Flow control circuit	254	3.3.3 阅读短文	289
8.1.3 Directional control circuits	255	3.4 液压辅助元件	289
8.2 Other pneumatic circuits	257	3.4.1 管道与管接头	289
Chapter 9 Typical Pneumatic System Diagrams	263	3.4.2 过滤器	290
9.1 Typical pneumatic system diagram I	263	3.4.3 蓄能器	290
9.1.1 Pneumatic system diagram	263	3.4.4 冷却器	291
9.1.2 Reading essay	263	3.4.5 油箱	292
9.2 Typical pneumatic system diagram II	265	3.4.6 密封件	293
9.2.1 Pneumatic system diagram	265	3.4.7 热交换器	294
9.2.2 Reading essay	265	3.4.8 压力表和压力表开关	295
9.3 Reading essay	266	3.4.9 阅读短文	295
		第4章 液压回路	296
		4.1 液压基本回路	296

4.1.1 压力控制回路	296	7.4 气动辅助元件	316
4.1.2 速度控制回路	298	7.4.1 润滑元件	316
4.1.3 方向控制回路	301	7.4.2 空气处理组件	316
4.2 其他常见回路	302	7.4.3 消声器	317
4.2.1 同步控制回路	302	7.4.4 气动传感器	317
4.2.2 顺序动作回路	303	7.4.5 气动放大器	317
4.2.3 伺服控制回路	304	7.4.6 转换器	318
4.2.4 阅读短文	304	7.4.7 管道系统	318
第5章 典型液压系统图例	305	7.4.8 阅读短文	318
5.1 典型液压系统图例 I	305	7.5 真空元件	318
5.1.1 【略】	305	7.5.1 真空发生装置	318
5.1.2 短文翻译	305	7.5.2 真空吸盘	319
5.2 典型液压系统图例 II	307	7.5.3 真空用气阀	319
5.2.1 【略】	307	7.5.4 真空压力开关	320
5.2.2 短文翻译	307	7.5.5 阅读短文	320
5.3 阅读短文	309	第8章 气动回路	321
第6章 气压工作介质	310	8.1 基本气动回路	321
6.1 压缩空气	310	8.1.1 压力控制回路	321
6.2 阅读短文	310	8.1.2 速度控制回路	322
第7章 气动元件	311	8.1.3 方向控制回路	322
7.1 气源装置	311	8.2 其他气动回路	323
7.1.1 空气压缩机	311	第9章 典型气动系统图例	325
7.1.2 储气罐	312	9.1 典型气动系统图例 I	325
7.1.3 后冷却器	312	9.1.1 气动系统原理图	325
7.1.4 阅读短文	312	9.1.2 阅读短文	325
7.2 气动控制元件——气动阀	312	9.2 典型气动系统图例 II	326
7.2.1 方向控制阀	312	9.2.1 气动系统原理图	326
7.2.2 压力控制阀	313	9.2.2 阅读短文	326
7.2.3 流量控制阀	314	9.3 阅读短文	326
7.2.4 阅读短文	314	Appendix A Graph Symbols of	
7.3 气动执行元件——气缸和气动马达	314	Common	327
7.3.1 气缸	314	Reference	
7.3.2 气动马达	315	参考文献	333
7.3.3 阅读短文	315		

Chapter 1 Basic Terminology in Hydraulic Transmission

1.1 Terminology list

absolute pressure	bag type
绝对压力	皮囊式蓄能器
actuator portion	basic/common circuit
执行元件	基本/常用回路
adiabatic exponent	bent axis axial piston pump
绝热指数	斜轴式无铰柱塞泵
adiabatic (isentropic)	buffer circuit
绝热状态	缓冲回路
adjusting piston	buffer throttle valve
变量活塞	缓冲节流阀
air compressor	bulk modulus of elasticity
空气压缩机	体积弹性模量
air cylinder	cavitation
气缸	气穴
air dryer	clamping
干燥器	夹紧
air motor	clearance
气马达	间隙
air supply device	clip
气源装置	卡套
air supply system	combined machine tools
气源系统	组合机床
air-hydraulic linkage control circuit	common cylinder
气液联动速度控制回路	普通气缸
amplifier	compound seals
放大器	组合密封圈
assistant element	compressibility
辅助元件	可压缩性
axial piston pump	connecting rod
轴向柱塞泵	连杆
	constant power variable displacement
	恒功率变量

control element	derivative regulator
控制元件	微分调节器
controlling piston	diaphragm cylinder
控制活塞	膜片式气缸
conservation of energy	diesel
能量守恒定律	柴油机
conservation of mass	directional control circuit
质量守恒定律	方向控制回路
conservation of momentum	displacement
动量守恒	排量
crank shaft	drainage valve
曲轴	排水阀
creep	drilling
爬行	钻
critical load	dustproof ring
临界载荷	防尘圈
critical reynolds number	dynamic viscosity
临界雷诺数	动力（绝对）黏度
cushion collar	°E viscosity
缓冲套	恩氏黏度计
cushion device	eccentric wheel
缓冲装置	偏心轮
cylinder block assembly	electric touch pressure gauge
缸体组件	电接触式压力表
cylinder block	electro-hydraulic digital valve
缸体	电液数字阀
cylinder spool orifice	electro-hydraulic operated directional control valve
圆柱滑阀阀口	电液换向阀
cylinder tube	electro-hydraulic proportional shift directional valve
缸筒	电液比例换向阀
damping groove (or hole)	electro-hydraulic proportional valve
减振槽（孔）	电液比例阀
decompression gap	电液比例阀
卸荷沟	electro-hydraulic servo valve
de-energized	电液伺服阀
（电磁铁）失电	energized
delivery	（电磁铁）得电
排量	energy portion
depth filter	能源装置
深度型过滤器	

equation of Bernoulli	force increased by air-hydraulic intensifier
伯努利方程	气液增压器增力回路
equation of continuity	force increased by multiple in-line cylinders
流量连续性方程	串联气缸增力回路
equation of momentum	functions of neutral position
动量方程	中位机能
execute signal	gag bit
执行信号	衔铁
exhaust throttle valve	gas filter for de-water
排气节流阀	分水滤气器
expand with heat and contract with cold	gas filter
热胀冷缩	过滤器
fast moving onward	gear modulus
快进	齿轮模数
fast return	gear pump
快退	轮泵
fast speed circuit	glyd ring seal
快速回路	格来圈密封
feeding	group panes
送料	方格群
filter rating	guide ring
过滤度	导向环
fixed/variable delivery	hand wheel
定量/变量	手轮
flange	hands-off circuit
法兰	互不干扰回路
flow control electro hydraulic proportional	heat exchanger
servo valve	热交换器
电液比例流量阀	heat-exchanger
flow pulsation	热交换器
流量脉动	high-pressure and low-pressure changeover
flow rate	circuit
流量	高低压切换回路
flow sensor	housing of variable displacement mechanism
流量传感器	变量机构壳体
flow-deploying	hydraulic cylinder
配流机构	液压缸
force control circuit	hydraulic jack
力控制回路	液压千斤顶
	Hydraulic lock
	液压卡紧现象

hydraulic operated valve	lock up circuit
液控阀	锁紧回路
hydraulic pump	losses of along circle parallel pipe
液压泵	沿程压力损失
hydraulic shock	mass flux
液压冲击	质量流量
hydraulic transmission circuits	local pressure loss
液压传动回路	局部压力损失
hydrostatics	muffler
液体静力学	消声器
impact cylinder circuit	needle roller bearing
冲击气缸回路	滚针轴承
impact cylinder	non-return valve
冲击气缸	单向阀
inlet port	nut
吸油窗口	螺母
inner semi-ring joint	obstruct
内半环连接	障碍
integral regulator	offset
积分调节器	偏心距
interlock circuit	oil and water separator
互锁回路	油水分离器
joint	oil escape valve
接头	放油塞
key	oil film
键	油膜
kinematic viscosity	oil leakage path
运动黏度	泄油通道
kinetic correction factor	oil mist lubricator
动能修正系数	油雾器
laminar flow	oil pipe
层流	油管
leakage	orifice shape of poppet valve
泄漏	锥阀阀口
lip seal	O-ring seal
唇形密封	O形密封圈
lip style sealing	outlet port
唇形密封圈	压油窗口
load-sensitive variable displacement	outlet power
负载敏感变量	输出功率

outside load	pneumatic sensor
外负载	气动传感器
over-load protection circuit	polytropic change
过载保护回路	多变过程
pad	polytropic exponent
挡圈	多变指数
parallel pin	port end cover
圆柱销	压盖
Pascal's law	position limited valve
帕斯卡定律	限位阀
phenomenon of surrounded oil	position sensor
困油现象	位置传感器
pilot operated valve	power-slipway
先导阀	动力滑台
pin	power
拔销	功率
pin shaft	pressure control circuit
销轴	压力控制回路
pipe line	pressure control electro hydraulic propor-
管道	tional servo valve
pipeline connector	电液比例压力阀
管道连接件	pressure counter-balance circuit
piston	平衡回路
活塞	pressure loss along parallel pipe
piston assembly	沿程压力损失
活塞组件	pressure regulated circuit
piston type	调压回路
活塞/柱塞式蓄能器	pressure sensor
plastic composite type seal	压力传感器
橡塑组合密封	pressure-holding circuit
plastic injection molding machine	保压回路
注塑机	pressure-increasing circuit
plunger	增压回路
柱塞	pressure-limiting variable displacement
pneumatic components	限压式变量
气动辅件	pressure-reducing circuit
pneumatic logical element	减压回路
气动逻辑元件	pressure-venting circuit
pneumatic manipulator	卸载回路
气控机械手	

pressure	retaining ring
压力	卡环
proportional regulator	reynolds number
比例调节器	雷诺数
proportional solenoid	ring set
比例电磁铁	套环
purification	rodless cylinder
净化	无杆气缸
quick return circuit	roller bearing
快速返回回路	滚柱轴承
rack-piston cylinder	rolling group
齿条活塞液压缸	滚轮组
radial piston pump	rotary cylinder
径向柱塞泵	摆动式液压缸
rake	rotor
齿条	转子
rated pressure	roundwire snap ring connection
额定压力	钢丝挡圈连接
reaction ring	rubber pipe
压环	胶管
reaming	rubber with proof against oil
铰	耐油橡胶
receiver	safety circuit
储气罐	安全保护回路
reducing pressure valve	screw coupling
减压阀	螺钉连接
relative pressure	screw pump
相对（表）压力	螺杆泵
relative viscosity	seal ring
相对（条件）黏度	密封环
relief valve	seal support
溢流阀	密封座
relief valve	sealing device
溢流阀	密封装置
reservoir	self-priming suction
油箱	自吸能力
restoration	sequence action circuit
原位	顺序动作回路
retaining ring	sequence valve
护环	顺序阀

servo valve	suction/discharge
伺服阀	吸油/压油
shift oil flow direction circuit	supercharge cylinder
换向回路	增压缸
signal processing device	surface filter
信号处理装置	表面型过滤器
single/double-acting cylinder	swash plate
单/双作用气缸	斜盘
sliding shoe	synchronization circuit
滑履	同步回路
solenoid operated valve	the principle of Pascal application
电磁控制阀	帕斯卡（静压传递）原理
sound level	theoretical/practical flow rate
噪声指标	理论/实际流量
speed control circuit	thread coupling
速度控制回路	螺纹连接
speed regulating circuit by variable displacement pump	throttle speed-regulating circuit by fixed displacement pump
变量泵容积调速回路	定量泵节流调速回路
speed rigidity	thrust bearing
速度刚性	推力轴承
split pin	tight chamber
开口销	密闭容积
spring plate	tolerance
弹簧座	公差
spring ring	torque
弹簧挡圈	转矩
start-up with acceleration	transmission shaft
加速启动	传动轴
stator	turbulence flow
定子	紊流
steady flow	two-hand operation circuit
恒定流动	双手操作回路
stroke	V-style lip seal
行程	V形密封圈
suction oil pipe	vacuum
吸油管	真空、真空度
suction pressure	vane pump
吸入压力	叶片泵
	venting device
	排气装置

venting plug	焊接连接
排气塞	wetted perimeter
volumetric/mechanical overall efficient	湿周
容积/机械效率	workbench
Venturi meter	工作台
文丘利流量计	working going onward
viscometer	工进
黏度计	working pressure
volume loss	工作压力
容积损失	working situation
water separator rating	工况图
水分离率	Y-style lip seal
welding connection	Y 形密封圈

1.2 Short passages for reading

This chapter lists the basic terminology in hydraulic transmission, including concepts of hydraulic transmission, foundation of fluid mechanics, hydraulic components, hydraulic system, pneumatic components, pneumatic system and other professional terminology. Understanding these basic terms is the basis of reading and understanding hydraulic transmission and exchanging in the hydraulic field. Therefore it is very important.

Chapter 2 Hydraulic Medium

During the designing of equipment that requires fluid power, many factors are considered in selecting the type of system to be used—hydraulic, pneumatic, or a combination of the two. Some of the factors are required speed and accuracy of operation, surrounding atmospheric conditions, economic conditions, availability of replacement fluid, required pressure level, operating temperature range, contamination possibilities, cost of transmission lines, limitations of the equipment, lubricity, safety to the operators, and expected service life of the equipment.

After the type of system has been selected, many of these same factors must be considered in selecting the fluid for the system. This chapter is devoted to hydraulic fluids.

2.1 Types of hydraulic fluids

There have been many liquids tested for use in hydraulic systems. Currently, liquids being used include mineral oil, water, phosphate ester, water-based ethylene glycol compounds, and silicone fluids. The three most common types of hydraulic liquids are petroleum-based, synthetic fire-resistant, and water-based fire-resistant.

The main hydraulic medium in fluid power systems can be divided into different categories as shown in Table 2-1 according to their performance and their chemical composition.

Table 2-1 Types of hydraulic fluids

Hydraulic medium	Mineral oil-based Fluids	Ordinary hydraulic oil Anti-wear hydraulic oil Low solidifying-point hydraulic oil High viscosity index hydraulic oil Special hydraulic oil Machine oil Turbine oil	
		Fire-resistant Fluids	Oil in water emulsion Water-oil emulsion Water- glycol fluids High water-based fluids
	Fire-resistant Fluids	Water-based type	
		Synthetic type	Phosphate ester fluids Fatty acid ester fluids Halide fluids

(1) Petroleum-based fluids

The most common hydraulic fluids used in shipboard systems are the petroleum-based oils. These fluids contain additives to protect the fluid from oxidation (antioxidant), to protect system metals from corrosion (anticorrosion), to reduce tendency of the fluid to foam (foam suppressant), and to improve viscosity.

Petroleum-based fluids are used in surface ships' electro-hydraulic steering and deck ma-

chinery systems, submarines' hydraulic systems, and aircraft automatic pilots, shock absorbers, brakes, control mechanisms, and other hydraulic systems using seal materials compatible with petroleum-based fluids.

(2) Synthetic fire-resistant fluids

Petroleum-based oils contain most of the desired properties of a hydraulic liquid. However, they are flammable under normal conditions and can become explosive when subjected to high pressures, source of flame or high temperatures. Nonflammable synthetic liquids have been developed for use in hydraulic systems where fire hazards exist.

(3) Phosphate ester fire-resistant fluid

Phosphate ester fire-resistant fluid for shipboard use is covered by specification MILH-19457.

Drawbacks of phosphate ester fluids are that they will attack and loosen commonly used paints and adhesives, deteriorate many types of insulations used in electrical cables, and deteriorate many gasket and seal materials. Therefore, gaskets and seals for systems in which phosphate ester fluids are used are manufactured of specific materials.

(4) Silicone synthetic fire-resistant fluids

Silicone synthetic fire-resistant fluids are frequently used for hydraulic systems which require fire resistance, but which have only marginal requirements for other chemical or physical properties common to hydraulic fluids. Silicone fluids do not have the detrimental characteristics of phosphate ester fluids, nor do they provide the corrosion protection and lubrication of phosphate ester fluids, but they are excellent for fire protection.

(5) Lightweight synthetic fire-resistant fluids

In applications where weight is critical, lightweight synthetic fluid is used in hydraulic systems. MILH-83282 is a synthetic, fire-resistant hydraulic fluid used in military aircraft and hydrofoils where the requirement to minimize weight dictates the use of a low-viscosity fluid. It is also the most commonly used fluid in aviation support equipment.

(6) Water-based fire-resistant fluids

The most widely used water-based hydraulic fluids may be classified as water-glycol mixtures and water-synthetic base mixtures. The water-glycol mixture contains additives to protect it from oxidation, corrosion, and biological growth and to enhance its load-carrying capacity.

Fire resistance of the water mixture fluids depends on the vaporization and smothering effect of steam generated from the water. The water in water-based fluids is constantly being driven off while the system is operating. Therefore, frequent checks to maintain the correct ratio of water are important.

2.2 The name of the hydraulic oil

The name code of the hydraulic oil is expressed according the following order:

Category (L) - Group (H) - Specification of varieties Number

46anti-wear hydraulic oil: L-HM 46.

L: type (lubricants and related products).

HM: varieties (refined mineral oil with rust, oxidation and abrasion resistance, H is group code of L products, and it has application in the hydraulic system).

46: Digital (according to viscosity grade seated by GB/T3141—1994 standard).

2.3 The viscosity of hydraulic oil

When hydraulic oil flows, the inner friction hinders the flow of hydraulic fluid due to molecular interactions. The fluid's viscosity is a measure of the friction. Viscosity is one of the most important properties of hydraulic fluids. The viscosity of a liquid is affected by changes in temperature and pressure. As the temperature of a liquid increases, its viscosity decreases. That is, a liquid flows more easily when it is hot than when it is cold. The viscosity of a liquid increases as the pressure on the liquid increases.

Viscosity can be usually expressed by dynamic viscosity, kinematic viscosity and conditional viscosity, three methods. It is divided into seven grades. Temperature limits of hydraulic oil of different grades required in the hydraulic system are showed in Table 2-2.

Table 2-2 Temperature limits of hydraulic of different grades required in the hydraulic system

ISO Viscos- ity grade	Visco- sity index	Starting temperature of maximum viscosity limits/°C			Temperature of working viscosity/°C		the temperature of minimum viscosity limit when No wearing/°C (10mm ²)
		Gear Pump (2000mm ² /s)	Piston pump (1000mm ² /s)	Vane pump (500mm ² /s)	High-pressure system (25mm ² /s)	Low-pressure system (15mm ² /s)	
10	50	-30±2.5	-30±2.5	-27±2	16.5±3	28.5±3	40±3
	100	-39±2	-33.5	-31.5±2.5	14.5±3	27.5±3	40±3
	150	-50±2.5	-44±2.5	-37.5±2.5	12.5±3	26.5±3	40±3.5
15	50	-30.5±2	-26.5±2	-16±2	27±2.5	40±2.5	52±3
	100	-34.5±2	-28.5±2	-21.5±2	26.5±3	40±3	52.5±3
	150	-41±2	-34.5±2	-27±2.5	25±3	40±3	53±3.5
22	50	-23±2	-17±2	-10±2	36.5±2.5	52±3	62±3
	100	-28.5±2	-20±2	-13±2	36±3	53±3.5	64±3.5
	150	-35±2	-26±2	-18±2	35.5±3.5	54.5±4	66±4.5
32	50	-15±2	-9±2	-2±2	45.5±2	59±2	71±2.5
	100	-19.5±2	-13±2	-7±2	46±2.5	60.5±2.5	74±2.5
	150	-25.5±2.5	-18.5±1.5	-10±2	47±3	63±3	78±2.5
46	50	-9±1.5	-2.5±1.5	-15±1.5	53±2	66.5±2	79.5±2
	100	-13.5±1.5	-6.5±1.5	-1.5±2	54±2.5	69.5±2.5	83.5±2.5
	150	-20±1.5	-13±1.5	-3.5±2	56.5±2.5	74.5±3	90±3.5
68	50	-2.5±1.5	4±1.5	11±1.5	61±2	75±2	88±2
	100	-7.5±1.5	0±1.5	8±1.5	64.5±2.5	79.5±2.5	94±2.5
	150	-14±1.5	-6±1.5	3.5±2	67.5±3	86±3	103±3.5
100	50	3±1.5	9.5±1.5	17.5±1.5	67±2	83±2	96.5±2
	100	2±1.5	6±1.5	14.5±1.5	70.5±2.5	89.5±2.5	105±3
	150	-8±1.5	0.5±1.5	10±2	76±3	98.5±3	107±4