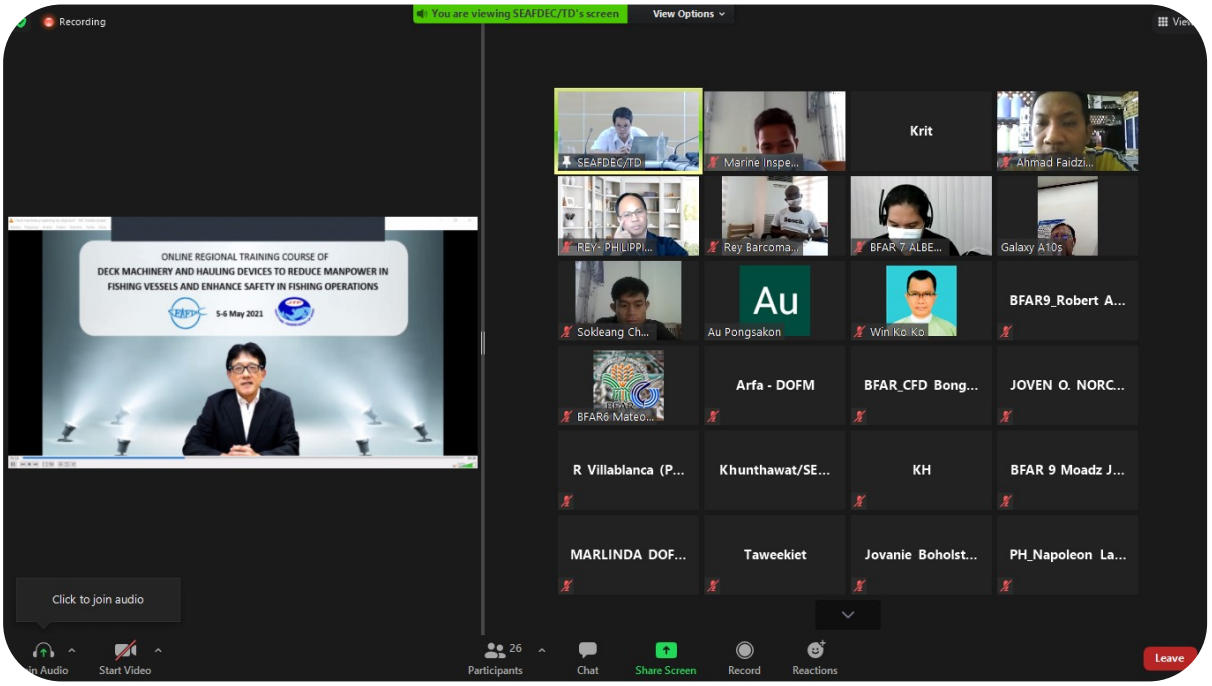
REPORT OF THE ONLINE REGIONAL TRAINING COURSE

ON

DECK MACHINERY AND HAULING DEVICES TO REDUCE MANPOWER IN FISHING VESSELS AND ENHANCE SAFETY IN FISHING OPERATIONS

5-6 May 2021

SEAFDEC Training Department, Thailand



Marine Engineering Section, Training and Research Supporting Division

Training and Information Section, Training and Research Supporting Division

Southeast Asian Fisheries Development Center-Training Department (SEAFDEC/TD)

Samut Prakan, Thailand 5-6 May 2021

ABSTRACT

This report is a part of an online regional training course on deck machinery and hauling devices on deck to reduce manpower in fishing vessels and enhance safety in fishing operations organized through the Zoom platform under the situation of the Corona Virus-2019 (COVID-19) pandemic to the Southeast Asian region and all over the world.

This online training course was envisaged to gather and update the technical information on capabilities to transfer the knowledge gained from the training program. It could be ways forward for improving hauling devices based on the hydraulic system in the respective area. It is noted that this training will be undertaken online. Participants are relevant working experiences in machinery or engineering from SEAFDEC Member Countries. The online training was granted by the Japanese Trust Fund 6, Phase II. There were 3 sessions at the online training: (1) Technical knowledge (2) Online demonstration (3) Discussion/evaluation. This report summarizes the main points made during the presentation and discussions on 5 -6 May 2021.

AUTHOR INFORMATION

The Marine Engineering Section under the Training and Research Supporting Division, Southeast Asian Fisheries Development Center, Training Department, Samut Prakan province, Thailand.

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I. INTRODUCTION

Referred to the Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030. Guided by the Resolution on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030, and the need to enhance collaboration among government agencies that have the responsibility for fisheries and fisheries-related issues to harmonize policies, plans, and activities that support sustainable fisheries, food safety and security at the national and regional levels. That the Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030 should serve as a priority action for AMSs in developing and implementing programs, projects, and activities in support of the implementation of the Resolution on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030.

18. Enhance the efficient use of energy by adapting appropriate technologies for fishing gear and fishing vessel design and fishing operations and promote the use of alternative energy sources.

19. Improve the capability of fishing crew and workers in the fishing industry and conduct educational and skills development programs for new crew members and workers entering the industry; while also adopt appropriate technologies to optimize the number of crews of the fishing vessels.

33. Intensify research on the impacts of various fishing gear types and methods on the ecosystem and populations of aquatic animals, and develop and promote environment-friendly fishing practices, e.g., low impact and fuel-efficient (LIFE) fishing gears/methods.

38. Ensure safety at sea, decent working conditions, and implementation of onboard fishing vessels sanitation, including the development of new design for fishing vessels, in compliance with relevant international standards.

Many years, SEAFDEC/TD with cooperation with the member countries had organized the on-site training course on optimizing energy use and safety at sea at the national level, year by year the training program and curriculum were developed appropriately for the fishing fleet and necessity of the countries such training program was conducted e.g., in Cambodia, Indonesia, Malaysia, Myanmar, The Philippines, and Viet Nam.

At the present, many people may not know how to use resources in terms of manpower and energy at their optimum points, some training programs are needed to increase working efficiency. SEAFDEC/TD with financial support from the Japanese Trust Fund (JTF6-2) to organize the Training Course on Deck Machinery and Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations for the member countries. This training course aims to raise awareness of how to utilize the use of the resource in terms of both workforce and energy-saving. In addition, this activity will be followed up by recommendations and suggestions from member countries. Unfortunately, with the COVID-19 pandemic, we would not be able to organize face-to-face activities. Thus, this training will be undertaken online instead.

II. OBJECTIVES

1. To share the implementation of appropriate hauling device system onboard including small, medium, and commercial scale.
2. To update the technical information/knowledge of the fisheries officials and other key officers of the existing methods and innovative techniques on deck machinery and

hauling device base on optimizing energy use and improving safety in fishing activities.

3. To share information to the SEAFDEC member countries to build up/strengthening fishing machinery and hauling devices, which reduce the use of manpower in fishing vessels and enhance safety in fishing operations; and
4. To build up a network of resource persons e.g., fishery extension in SEA sharing technical information on hauling devices, energy-saving, and safety at sea.

III. EXPECTED OUTPUTS

1. Participants will be able to transfer and utilize the knowledge and information on hauling devices, energy-saving, and safety at sea for capture fishery obtained from training to apply on their responsible area.
2. The participants will be able to identify threats, issues, and the way forward for promoting hauling devices, optimizing energy used, and safety at sea in capture fishery and fishing fleet.
3. The network of stakeholders can share and exchange information and technology on hauling devices, optimizing energy used, and safety at sea.

IV. COURSE STRUCTURE

This Online training course will be delivered in the three (3) major modules:

Module 1. Technical knowledge 60%

1.1 The Important of Hauling device onboard

- Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations

1.2 The Importance of Hydraulic system related to the fishing vessel.

- Fundamental of Hydraulic system
- The basic operation of hydraulics.
- Source of power units
- Hydraulic control
- Hydraulic safety equipment.

1.3 Hydraulic maintenance

- Routine and periodical Hydraulic maintenance

1.4 Hauling device for fishing vessels.

- Main hauling device for trawl and seine

Module 2. Online demonstration 20%

2.1 Hauling device for pilot purse seine fishing vessel (Commercial Fishery)
2.2 Hauling device for Trawl fishing vessel (Commercial fishery)
2.3 Hauling device for small fishing boat (Coastal Fishery)

Module 3. Discussion/evaluation 20%

V. ONLINE TRAINING COURSE SCHEDULE

Day	Time	Subject	Instructor
5 May 2021 (Day 1)	08:30-09:00 hrs.	Welcome and open the Online Regional Training Course of Deck Machineries and Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations	*TRSDH*
		General information on the online training program	*Mr. Khunthawat*
	09:00-10:30 hrs.	Introduction to concepts of oil hydraulics, Components. - Matching of hydraulic power source, - Working principles, and common problems, and. - Representative symbols	*Mr. Suthipong*
	10:30-12:00 hrs.	The Importance of Hydraulic system related to the fishing vessel. - Fundamental of the hydraulic system. - The basic operation of hydraulics - Source of power units - Hydraulic control - Hydraulic safety equipment.	*Mr. Khunthawat*
	12:00-13:00 hrs.	Luncheon	
	13:00-14:30 hrs.	Safety precautions and good watchkeeping practices. - Periodical maintenance of the hydraulic system	*Mr. Khunthawat*
	14:30-15:00 hrs.	Hauling device for fishing vessel - Main hauling device for trawl and seine	*Mr. Thaweesak*
6 May 2021 (Day 2)	09:00-12:00 hrs.	Online demonstration - Hauling device for pilot purse seine fishing vessel (Commercial Fishery) - Hauling device for Trawl fishing vessel (Commercial fishery) - Hauling device for small fishing boat (Coastal Fishery)	*MES*
	12:00-13:00 hrs.	Luncheon	
	13:00-14:00 hrs.	Discussion and Evaluation	*MES*
	14:00 hrs.	Closing	

VI. ONLINE TRAINING SESSIONS

OPENING SESSION:

Mr. Koichi Honda - Deputy Chief of the Training Department and Japanese Trust Fund manager, welcomed participants from SEAFDEC MCs who represented 5 (Five) SEAFDEC Member Countries, namely, Cambodia, Malaysia, Myanmar, the Philippines, and Thailand, and SEAFDEC Colleagues to the online Regional Training course and declared the training opened. He highlighted the project under Responsible Fishing Technology and Practices as supported by the Japanese Trust Fund and promotion of the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030. It is required to enhance collaboration among government agencies that are responsible for fisheries and fisheries-related issues to coordinate their policies and activities that support sustainable fisheries, food safety, and security at the national and regional levels and aims at raising awareness of how to utilize the resource in terms of both workforce and energy-saving. This activity provides information on the SEAFDEC pilot project for purse seine and trawls fishing vessel in Thailand, of which the main objective is optimizing energy and reducing manpower onboard.

Moreover, he expected that this online training course would be a significant contribution to update the current situation on the technology and fisheries engineering in term of reducing manpower onboard as shared by the SEAFDEC staffs and obtaining the needs of all MCS to pave the way forward for planning and implementing the project activities from 2021-2024.

He once again expressed his gratitude to all encouraged all SEAFDEC participants to learn and share experiences with them. Finally, he officially declared the online meeting opened and wished for a successful meeting. His opening remark appears in Appendix 1. The Participant's name list appears in Appendix 2**.**

TECHNICAL KNOWLEDGE:

Introduction to concepts of oil hydraulics and components (Mr. Suthipong T.) He is Training and Research Supporting Division Head. The highlights of his presentation consist of:

- Matching the hydraulic pump and prime mover
- The criteria of energy utilization
- Basic considerations for selecting a pump drive.
- The sizing and type of pumps required.
- Service factor (SF)

Regarding the above topics, Mr. Suthipong T. provided the technical knowledge and information on the introduction to concepts of oil hydraulics and components for the purpose to improve energy saving and energy utilization, reduce vessel and fishing operation costs, reduce the system and maintenance costs, compacts size more space and improve safety. The criteria of energy utilization were introduced in part of the fishing vessel; the propulsion engine or diesel generator has greater power delivering and a relatively steady amount of torque at both high and low running speeds. Consequently, the propulsion engine or diesel generator able to drive the hydraulic pump, providing enough power take-off as a mechanism to bring its power from at operating speed, therefore just correctly matched with the requirement for the hydraulic power unit as utilized as the power source. Furthermore, he

also mentioned the basic considerations for selecting a pump drive include sizing and type of pumps required, which begin with the basics. When engineering any new pumping or hydraulic system with pump drives and power take-offs, there are six basic things a user must consider that consisting of Multiple/split type power take-off, A hybrid is driven, Hydraulic gear pump, Hydraulic vane pump, Hydraulic axial piston pump, and radial piston pump. The last topic of the presentation related service factor (SF) needs to consider on diesel marine engine duty-cycle, heavy – medium – light-duty, pressure, and cooling system for the hydraulic hauling device.

The Importance of Hydraulic system related to the fishing vessel (Mr. Khunthawat M.) He is the Technology and Energy Engineering. The highlights of his presentation consist of the importance of the hydraulic system for the fishing vessels describes to the principle of transformation of power through a hydraulic medium by several types of hydraulic components including tank, pump, pressure relief valve, check valve, accumulator, directional control valve, and motor or cylinder. The electronic control part is for automatic or remote control of the hydraulic system. Each component and part is figured out and explained to clarify their operation followed each item. A video of installation technique of power takes off for small agricultural engine was given an example. A few demonstrate hydraulic circuits and operations were shown in few simulation figures. One important part of hydraulic element filters was addressed because of the cleaning of hydraulic oil affecting to operating life of the system. Some particles or dirt contaminated in hydraulic oil can seriously damage each hydraulic component which filters can eliminate these particles out. Another case of destroying the hydraulic system is heat that occurred during heavy operation. Rejecting out heat from hydraulic oil by cooler can disappear this failure cause. The sufficient cooling rate of the hydraulic oil cooler has to match with the system. Good understanding is still insufficient to handle the hydraulic system, but maintenance must also be contributed with high care. Low maintenance, less knowledge, low awareness of safety may lead to heavy severe destroy both component and worker. Some cases of hydraulic failure can kill workers be besides exploded hydraulic host. The safety concern is one crucial topic added in. Some hydraulic hauling devices or machinery applications, including purse seiner, trawler, net hauler, and line hauler, are shown in the circuit diagram and boat layout.

Hauling device for fishing vessel (Mr. Thaweesak T.) He is the Marine Engineering Section Head under the Training and Research Supporting Division. The detail of the presentation base on hauling equipment and device to reduce manpower onboard. The presentation on Hauling Device for Fishing Vessels shows labor-saving technologies such as smart reel, net drum for trawlers, demonstrated craned and power block supported by SEAFDEC/TD under Japanese Trust Fund to improve working and living condition onboard. A hydraulic system powers these technologies. One rapid transfer fish machinery called fish pump is a demonstrate machinery driven by a hydraulic motor to transfer fish from the sea toward fish hold in a short period. Some manpower-saving applications include hauler driven by a small engine, outboard engine, and diesel engine drive long tails boat.

Online demonstration:

On the second date, an online demonstration session was presented in terms of a video clip of applicable and newly developed fishing hauling technologies of small, medium, and commercial scale. During open stages after video presentations, participants shared, suggested, commented, or even requested SEAFDEC/TD on a face-to-face onsite training course on labor-saving hauling devices or machinery to be applied for their countries. To

clarify all figures of a newly developed fishing boat, Mr.Suthipong T. gave more details and overall aims of new demonstrated fishing boat covering the good practice of working/living condition, use manpower saving technologies, saving and efficient use of energy, and safety concerns. These advantages and solutions contributed to all audiences interested in the developed project. Look after interesting of this training program, and we achieved kind cooperation from member countries to attend during the program which has at least 16 attendees, name lists in Table 1, including, 1 from Laos, 2 from Cambodia, 2 from Malaysia, 1 from Myanmar, 9 from the Philippines, and 1 from Thailand.

Note: Electronic documents and media clips in the below link
https://drive.google.com/drive/folders/1rxvDz4MeYhlAfSpiZC297xDS-9bed01L

Discussions and recommendations:
On net hauler driven hydraulic system on the demonstrated trawler, some participants from BEFAR comments on destroying natural resource on the sea surface by trawl fishing gear which should be prohibited in the Philippine's water. However, the instructor suggested a new design of hydrodynamic otto board flying over the sea surface. Additionally, he addressed newly developed trawlers under good working conditions, convenience living, and hygienic onboard standards to attract new generations to work onboard with happiness. It was renovated under good practices of living accommodations including sufficient amount of individual bed of standard size, provided sufficient restroom, and attached with manpower-saving net hydraulic system. Fuel efficiency is also a concerning factor before new equipment, systems, or machinery to be installed on the developed fishing boat. One good practice fishing boat, found in Malaysia, as a good lesson learn to be applied such as RSW, hydraulic for net drum, power block, and crane. One interesting topic on the vessel monitoring system was that fishing boats over 30 GT have to be equipped for one item of endorsing port in port out process. A BEFAR participant suggested adopting labor-saving technology like installed on demonstrative purse seine fishing vessel for some local Philippines fishing boat. Myanmar participant advised SEAFDEC/TD to transfer manpower saving and working efficient technology for small-scale fishing boats that operated along the coastal zone. He will contribute and promote this technology to their local fishers in the future. Malaysian participant requested TD to arrange an on-site training course for watchkeeping and look after the good working operation of hauling devices and hydraulic system because of lack of this maintenance knowledge affecting shorting life operation of the system. The other requirements are drawing and specification of demonstrated devices and the labor-saving system as referenced documents that component can be developed/constructed by local makers. These documents will be uploaded and distributed through the link though online by assigned staff.

VII. EVALUATION RESULTS:

Almost nearly 85 % of attendees from member countries prefer to improve or update their knowledge or technology on hauling devices or machinery applied for labor-saving and working efficiency. Especially, hauling device driven by the hydraulic system is a key topic to be studied and achieved more information to be applied for their concerned jobs. Its two-day online training course is the most preference period and in May the best month is chosen. On all topics and instructors concerning hauling devices/machinery, demonstrated system, safety concerns were accepted in a range of excellent and satisfactory. Participating in this online session through the zoom platform was averaged in excellent and satisfying smooth operation without technical communication problems. Many positive feedbacks responded

by the attendees, but the most impressive matters were found in the training course. At the same time, comprehensive knowledge on hydraulic labor-saving systems and every topic had been discussed. New fish transfer devices like capsule pumps were an interesting topic. A video presentation had shown these updated technologies. Even though they accepted this online program's proficiency, many attended participants requested and addressed face-to-face training courses because of a lack of experience with the demonstrated machinery**.**

VIII. CLOSURE OF THE ONLINE TRAINING

Mr. Suthipong Thanasarnsakorn-Training and Research Supporting Division Head on behalf of SEAFDEC/TD expressed his sincere gratitude to the participants for attending the online training. He hopes that the knowledge and experience from online training can be helpful for SEAFDEC member countries. He finally extended his gratitude on behalf of the SEAFDEC Secretary-General to the Government of Japan, resource persons, and all participants for their support, valuable time shared for the online training, and active participation. He believed that this online training had been organized successfully and met the objectives.

IX. Acknowledgments

The online training organizers are grateful to all of the participants for positive engagement and active participation. Special thanks are due to the staff from the Training and Information Section for their full support and contributions in preparation and participation. This online Regional Training course was financed by the Japanese Trust Fund 6 Phase II under the Project Responsible Fishing Technology and Practice.

Appendix 1. Opening remark

Opening Speech for DSG

Online Regional Training Course on Deck Machinery and Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations

5-6 May 2021

Participants of the Online Regional Training Course, Officials of the SEAFDEC, Ladies, and Gentlemen, Good morning! On behalf of SEAFDEC/TD, I would like to welcome you all to the Online Regional Training Course on Deck Machinery and Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations. Due to the COVID-19 pandemic in the world, especially in Southeast Asia, we could not be able to organize face-to-face activities. Thus, this 2 days' training course will be undertaken through the Zoom platform.

For the promotion of the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030, it is required to enhance collaboration among government agencies that are responsible for fisheries and fisheries-related issues to coordinate their policies and activities that support sustainable fisheries, food safety and security at the national and regional levels.

This online training course aims at raising awareness of how to utilize the resource in terms of both workforce and energy-saving. And this activity provides information on the SEAFDEC pilot project for purse seine and trawl fishing vessels in Thailand of which the main objective is optimizing energy and reduction of manpower onboard. This activity is conducted under the project Responsible Fishing Technology and Practices with financial support from the Japanese Trust Fund (JTF-6 phase II). As reported by Mr. Thaweesak, this online training course consists of technical knowledge, Online demonstration, and Discussion/evaluation. I hope that this online training program would be a fruitful one. And I do believe that you could transfer what you have learned here to your countries.

With this, now I declare this Online Training Course open. Have a good day.

Thank you very much.

Appendix 2. List of Participants

CAMBODIA	
1. Mr. Chhom Sokleang, Officer of Marine Fisheries Administration Inspectorate	Email: chhornsokleang@yahoo.com
2. Mr. Khem Heng, Officer of Marine Fisheries Administration Inspectorate	Email: khemsokheng77@gmail.com
MALAYSIA	
3. Mr. Ahmad Faidzi bin Kastolany**,** Senior Fisheries Officer	Email: faidzi@dof.gov.my
4. Mrs. Marlinda Anim Binti Marham, Senior Fisheries Officer	Email: marlinda@dof.gov.my
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7. Yusri bin Yusof, other contact people	Email: yusri@dof.gov.my
MYANMAR	
8. Mr. Win Ko Ko, Assistant Director of Fishing Technology	Email: kowinko.dof@gmail.com
PHILIPPINES	
9. Mr. Remegio P. Salinas (MFDVOC)	Email: napolamarca@yahoo.com
10. Mr. Ronald D. Villablanca (MFDVOC)	
11. Mr. Ferdinand A. Tividad (CFD)	
12. Mr. Ramil F. Labiano (MFDVOC)	
13. Mr. Napoleon Lamarca (Contact person)	
14. Mr. Joven O.Norcio	Email: bfarreight@yahoo.com
15. Mr. Johnrhey B. Garcia	
16. Mr. Reginald Laxum Atabay	Email: bfarrfo1_records@yahoo.com
17. Mr. Dwight de Leon (Contact person)	Email: dwight_deleon@yahoo.com
18. Mr. Lito moises b. buitizon	
19. Mr. Dwight e. de leon	
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22. Mr. Moadz t. Janjawi	Email: moadzjanjawi51@gmail.com
23. Mr. Francisco Dollesin	Email: bfar5.rftfcd@gmail.com
24. Mr. Alexander Auro	
25. Mr. Francis Buendia	
26. Mr. Ricardo Francia	
27. Mr. Rey Barcoma	
28. Mr. Eric Ballaran	
29. Mr. Felix Navarete	
30. Mr. Jovanie Boholst	
THAILAND	
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32. Mr.Pongsakon Chantapanit, Fishery Biologist, Practitioner level	Email: pongauza@gmail.com
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33. Dr. Taweekiet Amornpiyakrit	Email: taweekiet@seafdec.org
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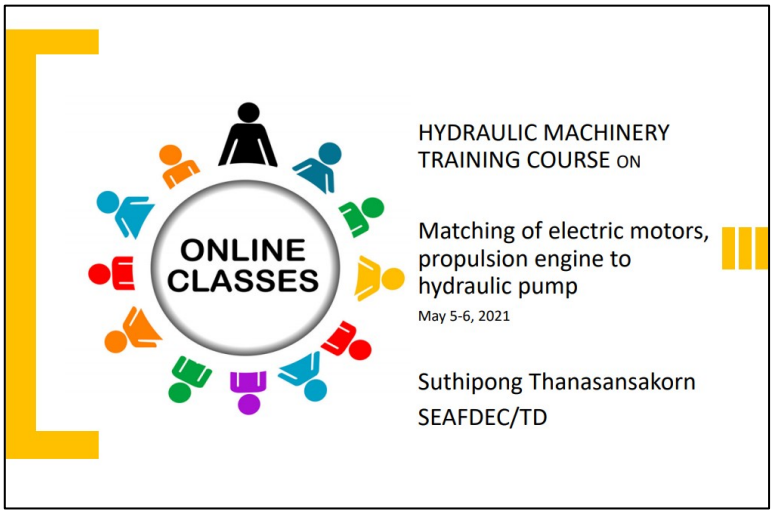
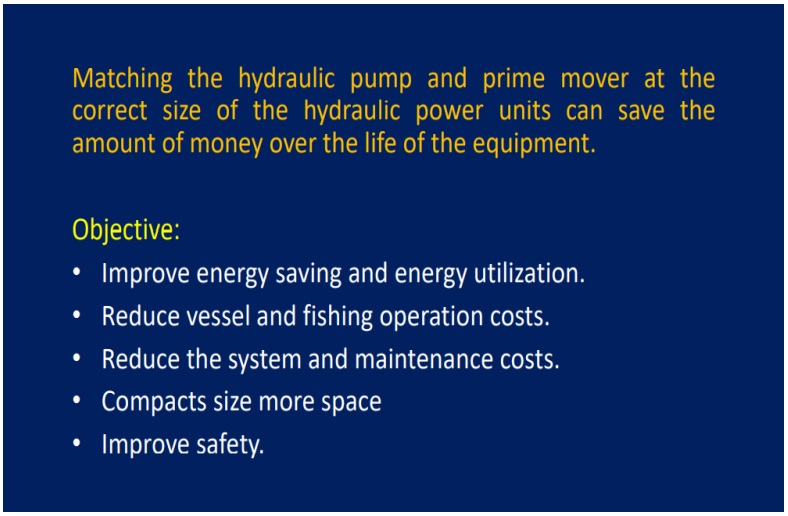
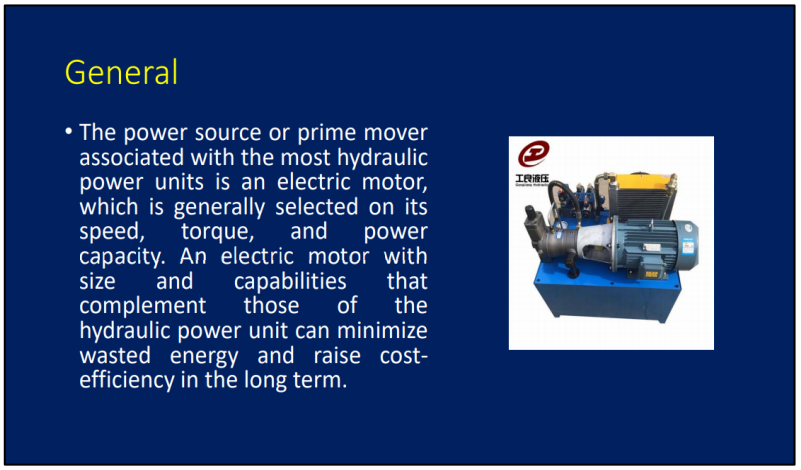
37. Mr. Masanami Izumi	Email: izumi@seafdec.org
38. Mr. Thaweesak Thimkrap	Email: thaweesakt@seafdec.org
39. Mr. Khunthawat Manomayidthikarn	Email: khunthawat@seafdec.org
40. Acting Sub. Lt. Anusorn Chanyim	Email: anusorn@seafdec.org
SEAFDEC/TD Facilitators	
41. Mr. Krit Phusirimongkol	Email: krit@seafdec.org
42. Mr. Tanapat Sorragittayamate	Email: tanapat@seafdec.org

Appendix 3. Presentations in PowerPoint *(Introduction to concepts of oil hydraulics and components)*







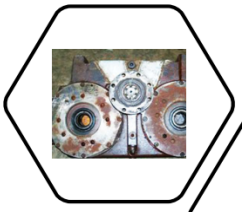
The criteria of energy utilization

- In a fishing vessel, the propulsion engine or diesel generator has greater power delivering and a relatively steady amount of torque at both high and low running speeds.
- Consequently, the propulsion engine or diesel generator able to drive the hydraulic pump, with providing enough power take-off as a mechanism to bring its power from at operating speed, therefore just properly matched with the requirement for the hydraulic power unit as utilized as the power source

BASIC CONSIDERATIONS FOR SELECTING A PUMP DRIVE.

Let's begin with the basics. When engineering any new pumping or hydraulic system with pump drives and power take-offs, there are six basic things you must consider – before beginning to creating blueprints, plans, and other project details. Here is a quick overview of each concern.

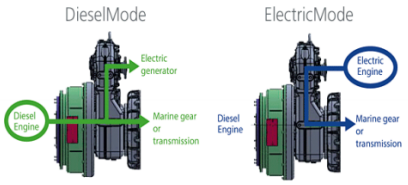
Multiple/split type power take-off



- The multiple or split type drive is equipment as gear box or power take-off application to allows a single or a multiple of pumps to be driven from a single prime mover.

A **hybrid drive**

Is a combination of different propulsion technologies. In the hybrid transmission system, an electric motor performs a function in place of the engine, such as exerting force to the transmission shaft.



The sizing and type of pumps required.

A simple process to select suitable pumps that will deliver enough power to meet all application demands. (flows volume)

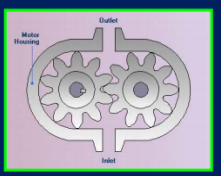
The total flows (Qt) = Q1 + Q2 + Q3 + Qn

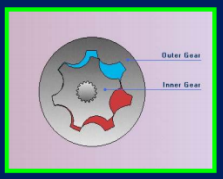
The design flows (Qt) = (1.4 $Q_{Largest}$) Q2 + Q3 + Qn

Hydraulic pumps

GEAR PUMP

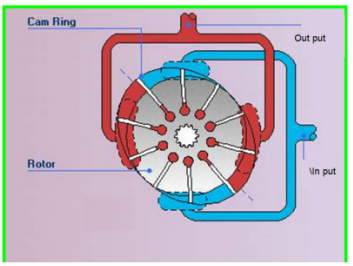
- Higher power output for a given outer dimensions.
- Overall efficiency low.
- Volumetric efficiency low.
- Low cost.
- Rotation at low speed not smooth.
- Higher heat generation (loss of energy)





VANE PUMP

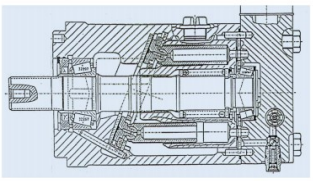
- DESIGN COMPLICATED
- MANUFACTURING COMPLICATED
- HIGH COST
- MEDIUM FLOWS
- MEDIUM SPEED
- VARIABLE FLOWS IS POSSIBLE



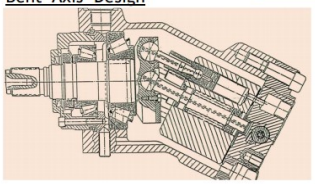
AXIAL PISTON PUMP

HIGH SPEED
COMPLICATED DESIGN
MANUFACTURING DIFFICULT
HIGH COST
BI ROTATION POSSIBLE
SPEED VARIATION POSSIBLE
FLOWS VARIATION POSSIBLE

Swash Plate Design

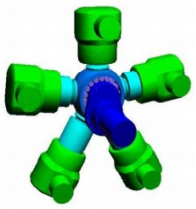


Bent Axis Design



RADIAL PISTON PUMP

- HIGH PRESSURE
- HIGH FLOWS
- COMPACT IN SIZE
- BI-DIRECTIONAL
- LOW SPEED POSSIBLE (< 10 rpm)
- FLOWS VARIATION POSSIBLE
- LOW NOISE
- VIBRATION VERY LOW
- HIGH MECHANICAL EFFICIENCY
- HIGH VOLUMETRIC EFFICIENCY



2) Maximum torque requirements.

It is time to consider the maximum requirement of hauling capacity or load requirements.

Need to make sure the number of your application, to ensure smooth and steady operation.

It is depending upon : *Q = flow rate (l/min)*
D = displacement of piston
n = revolutions (rpm)
P= delivery pressure (kg,cm2)

Supply to the load duty at a certain speed

3) Maximum input torque.

This is where your prime mover being engine or electric motor.

In the case of engine drive, the powers take-off or PTOs come into the system.

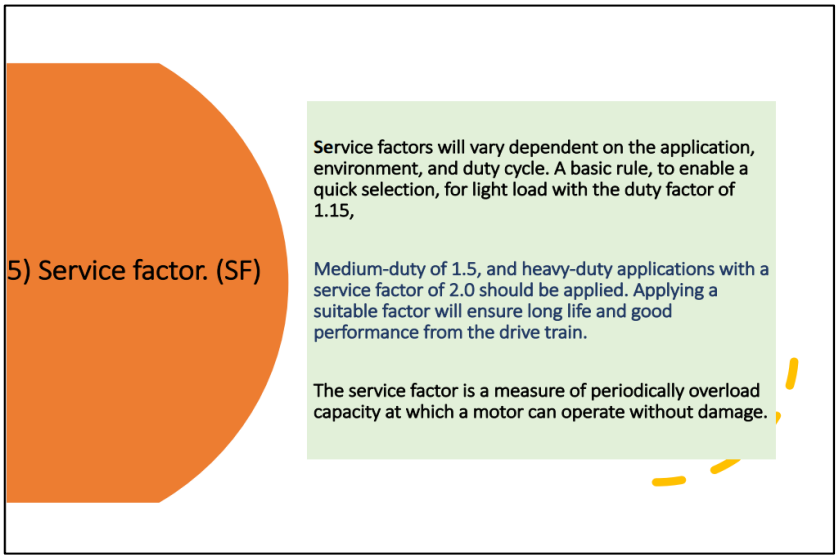
Make sure size of the **reducer gearbox without breaking it?**

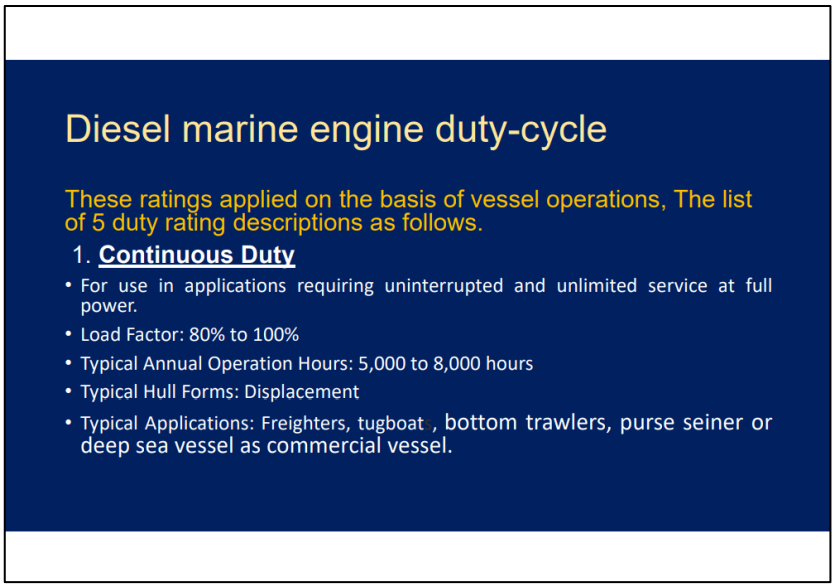
The gearbox has to be provided with special bearings or lubricating and housing designs to accommodate the high loads on the pump input shaft.

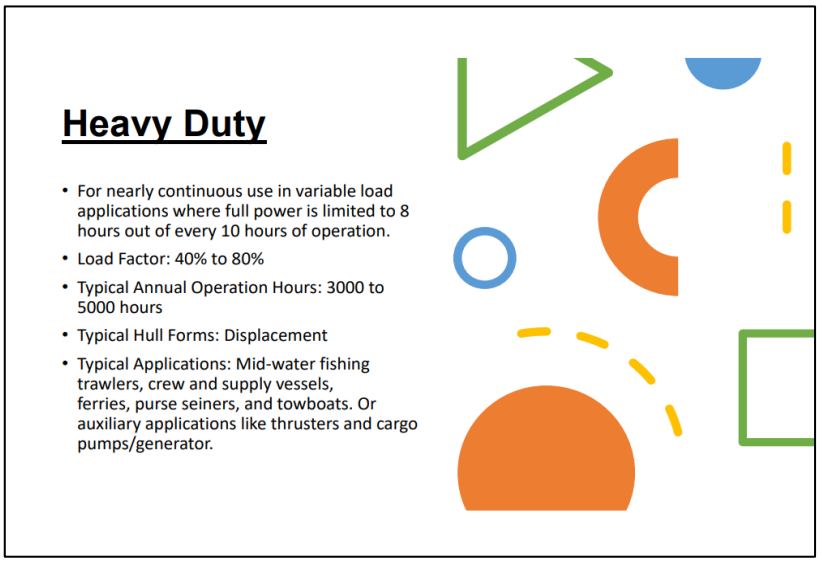
4) Maximum input speed.

When designing a new pump system, maximum input speed should be examined to ensure that the chosen pump can accept the maximum input speed of the prime mover.

Whatever pump you choose, you should also make sure that the pump direction of rotation is the same rotation as the flywheel/drive shaft when the pump is viewed from its shaft end, to ensure compatibility.


5) Service factor. (SF)
Service factors will vary dependent on the application, environment, and duty cycle. A basic rule, to enable a quick selection, for light load with the duty factor of 1.15,
Medium-duty of 1.5, and heavy-duty applications with a service factor of 2.0 should be applied. Applying a suitable factor will ensure long life and good performance from the drive train.
The service factor is a measure of periodically overload capacity at which a motor can operate without damage.


Diesel marine engine duty-cycle
These ratings applied on the basis of vessel operations, The list of 5 duty rating descriptions as follows.
1. Continuous Duty
• For use in applications requiring uninterrupted and unlimited service at full power.
• Load Factor: 80% to 100%
• Typical Annual Operation Hours: 5,000 to 8,000 hours
• Typical Hull Forms: Displacement
• Typical Applications: Freighters, tugboat , bottom trawlers, purse seiner or deep sea vessel as commercial vessel.


Heavy Duty
• For nearly continuous use in variable load applications where full power is limited to 8 hours out of every 10 hours of operation.
• Load Factor: 40% to 80%
• Typical Annual Operation Hours: 3000 to 5000 hours
• Typical Hull Forms: Displacement
• Typical Applications: Mid-water fishing trawlers, crew and supply vessels, ferries, purse seiners, and towboats. Or auxiliary applications like thrusters and cargo pumps/generator.

Medium Duty

- For moderate use in variable load applications where full power is limited to 6 hours out of every 12 hours of operation.
- Load Factor: 20% to 80%
- Typical Annual Operation Hours: 2,000 to 4,000 hours
- Typical Hull Forms: Semi-displacement and displacement
- Typical Applications: Ferries, harbor tugs, fishing boats, fish carier (designed for high speed), offshore service vessels, (non-cargo) displacement hull yachts, or short trip.

Light Duty

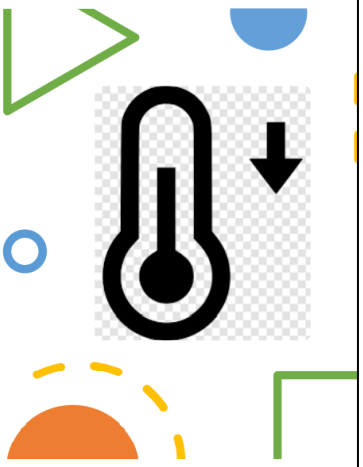
- For intermittent use in variable load applications where full power is limited to two hours out of every eight hours of operation.
- Load Factor: Up to 50%
- Typical Annual Operation Hours: 1000 to 3000 hours per year
- Typical Hull Forms: Planning and semi-displacement
- Typical Applications: Offshore patrol vessels, customs vessels, police vessels, some non-net fishing, fire vessels, military and police vessels, or harbor tugs. Or auxiliary applications like emergency fire pumps and hydraulic power packs.

Pleasure Duty

- For infrequent use in variable load applications where full power is limited to one hour out of every eight hours of operation.
- Load Factor: Up to 30%
- Typical Annual Operation Hours: 250 to 1000 hours
- Typical Hull Forms: Planning
- Typical Applications: Pleasure craft, harbor patrol boats, harbor master boats, some fishing or patrol vessels, sport fishing, motor yachts, and cruisers.

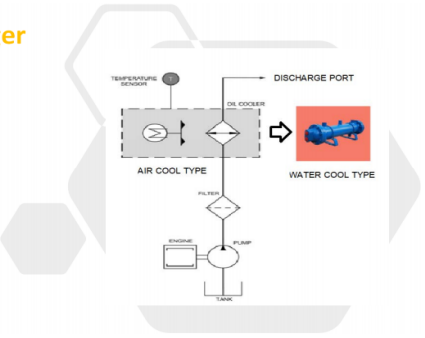
6) Cooling.

When selecting a PTO gearbox it is important to consider the thermal characteristics of the gearbox which will be based upon the material of the gearbox casing and the surface area the heavy duty work incase of marine used the lubricating oils and heat exchanger will equiuped.



6) Cooling /heat exchanger

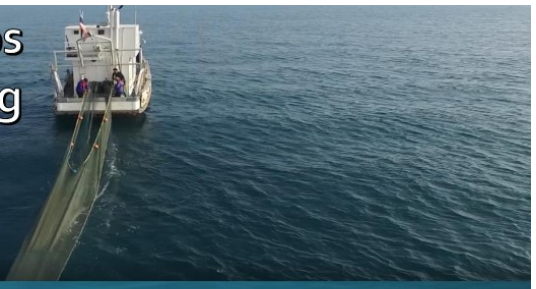
When selecting a PTO gearbox, it is important to consider the thermal characteristics of the gearbox which will be based upon the material of the gearbox casing and the surface area the heavy-duty work incase of marine used the lubricating oils and hydraulic oil should be cool at working temperature heat exchanger will provide.



THANK YOU VERY MUCH
for your attention

Appendix 4. Presentations in PowerPoint *(Hauling device for fishing vessel)*

Net Drum Helps Increase Fishing Efficiency in Trawlers

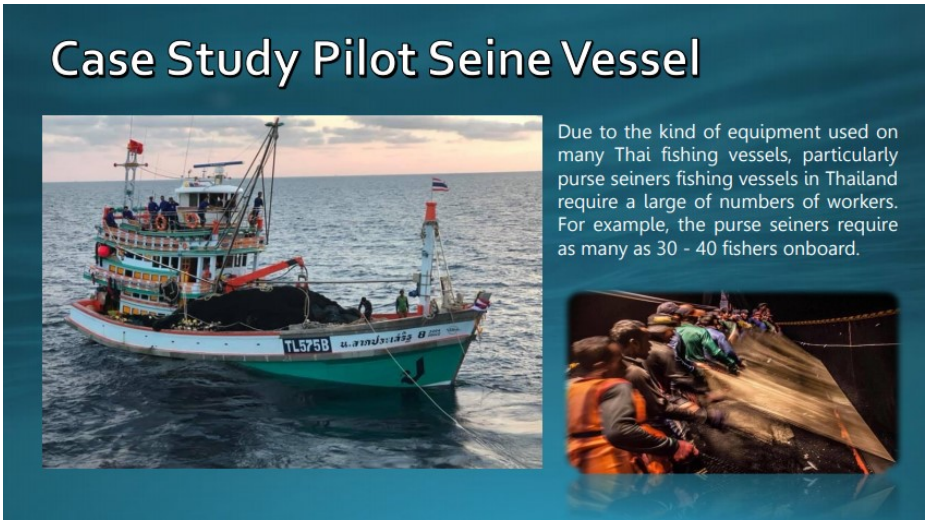


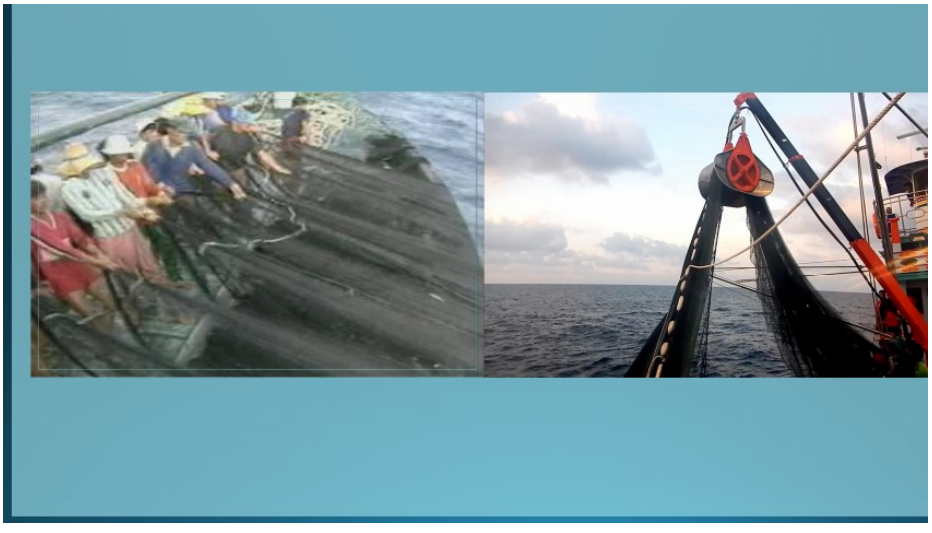
Trawl fisheries play the importance role to support marine product in Southeast Asian Countries. Since 1960,

The bottom trawl fisheries promotion aimed to utilize marine fisheries resources as a source of protein to meet the demands of the rapidly growing population. In the 1970s, the bottom trawl fisheries have been known throughout the Southeast Asian region. Thailand, Malaysia, and Indonesia are now the lead countries in trawl fishing industry in the region.

In recent years, the towing warp winch has become popular among trawlers. This winch is used both to haul the trawl warp up to the otter board, or the trawl net on deck. Since the 1980s, net drums have become popular among stern trawlers. Using the drums in operating the trawl not only makes it easier to maneuver the trawl, but it also becomes easier to handle the fishing gear. Using the stern drums can also help the skipper to avoid the net entanglement with the vessel's propeller

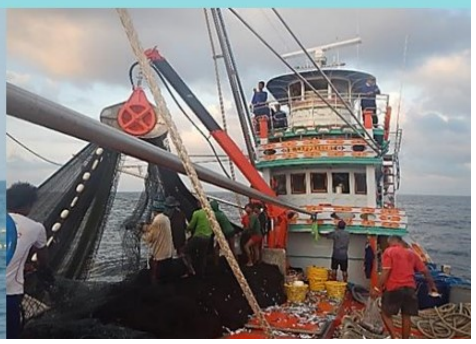
Among the Southeast Asian countries, trawlers from Malaysia, Indonesia, and Brunei Darussalam are largely equipped with one or two hydraulic net drums on stern deck. The option for the second net drum depends on the additional cost or the type of trawl net they operate. On the other hand, the manual net drums are more popular among small (<14 m) Thai and Cambodian trawlers.

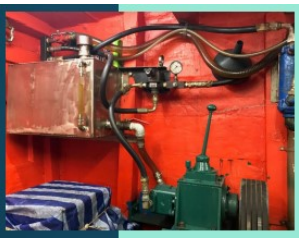

Case Study Pilot Seine Vessel
Due to the kind of equipment used on many Thai fishing vessels, particularly purse seiners fishing vessels in Thailand require a large of numbers of workers. For example, the purse seiners require as many as 30 - 40 fishers onboard.

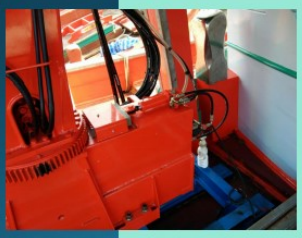


Thai traditional purse seine fishing vessel hauling the net from both sides, port and starboard sides with manpower nearly 40 crew members onboard (before installation fishery machinery)

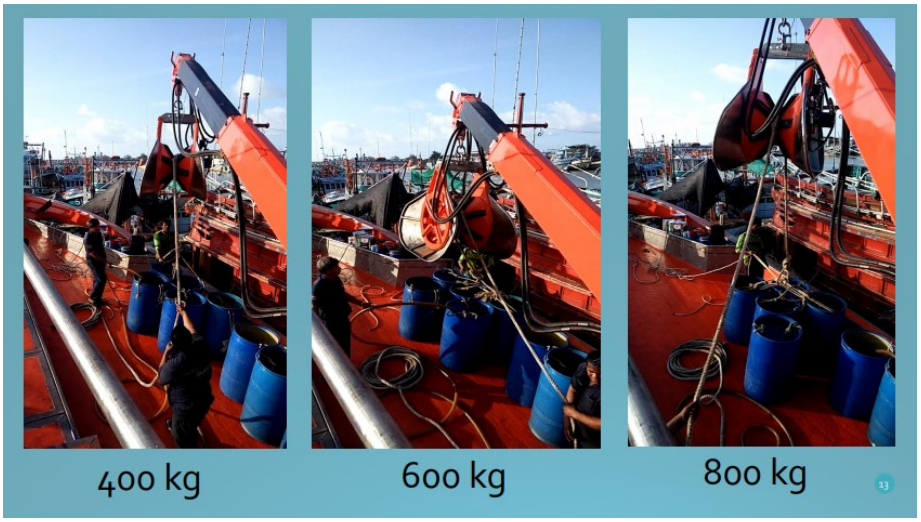
Thai purse seine fishing vessel hauling net only from starboard side with only 16 crew members onboard after installation fishery machinery, *e.g.* hydraulic crane, power block

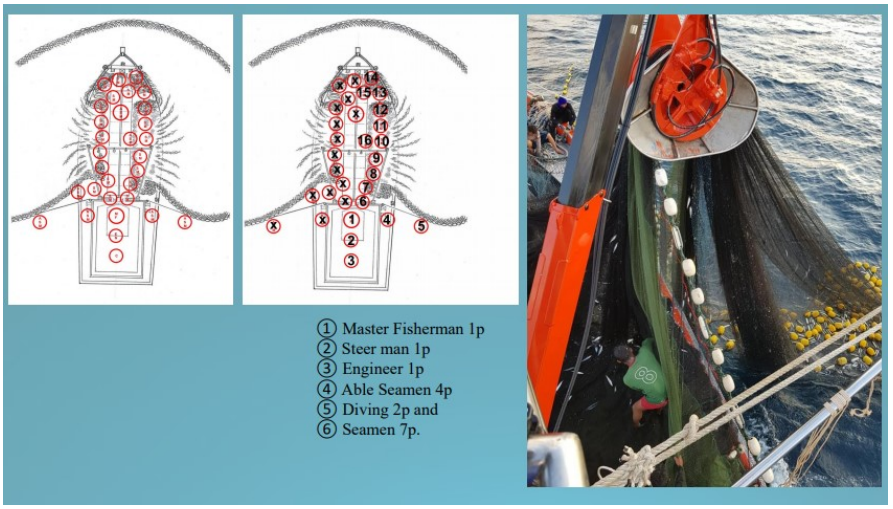


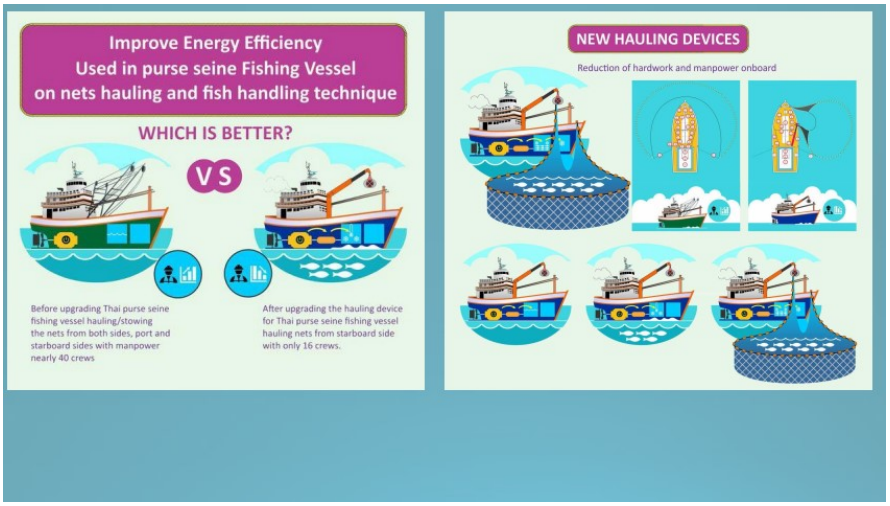


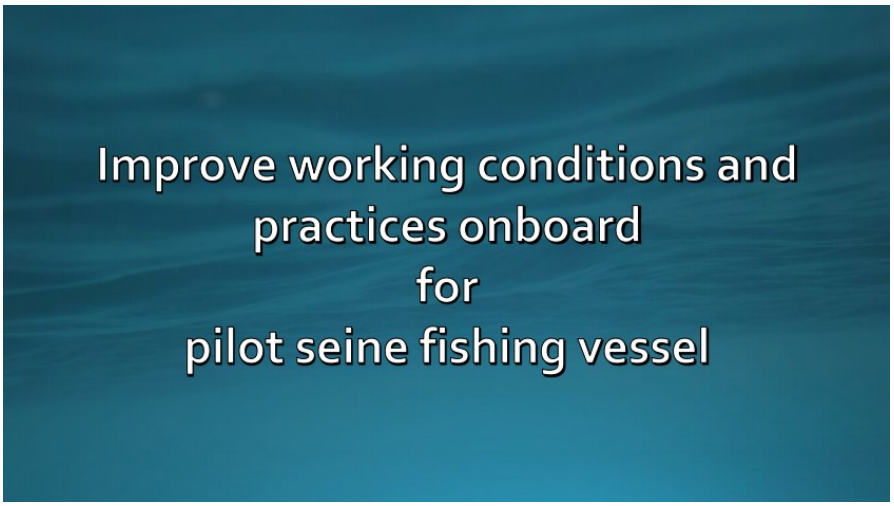


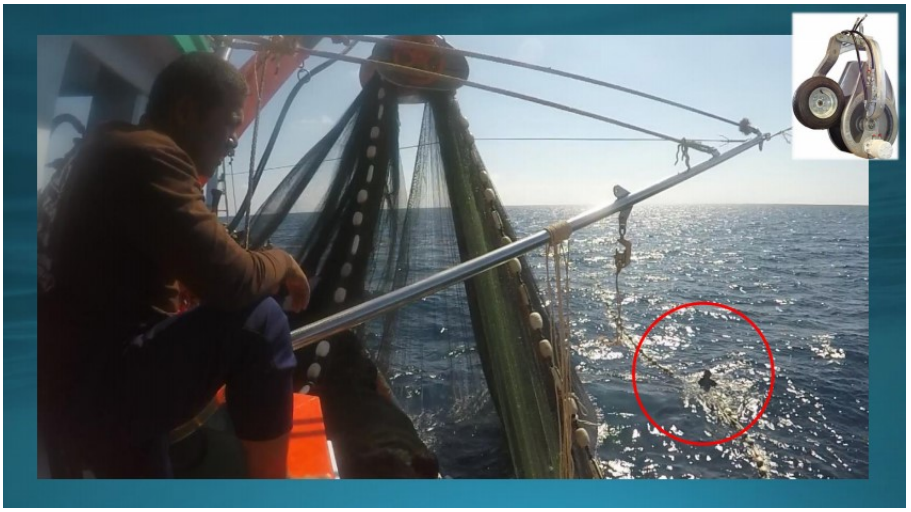
VS


400 kg
600 kg
800 kg


① Master Fisherman 1p
② Steer man 1p
③ Engineer 1p
④ Able Seamen 4p
⑤ Diving 2p and
⑥ Seamen 7p.


Improve Energy Efficiency
Used in purse seine Fishing Vessel
on nets hauling and fish handling technique
WHICH IS BETTER?
VS
Before upgrading Thai purse seine fishing vessel hauling/stowing the nets from both sides, port and starboard sides with manpower nearly 40 crews
After upgrading the hauling device for Thai purse seine fishing vessel hauling nets from starboard side with only 16 crews.
NEW HAULING DEVICES
Reduction of hardwork and manpower onboard


Improve working conditions and
practices onboard
for
pilot seine fishing vessel



To eliminating the risk and improve the working condition at sea and reduce nets slippage. Especially in the large catch or bad weather conditions, Therefore SEAFDEC/TD introduces the existing techniques are applied by installing a power grip (pusher wheel) into the power block of the local pilot purse seine fishing vessel for better net hauling efficiency. Its design ensures safe working conditions more direct net hauling, and reduces manpower, with fewer nets wears down.

Advantage

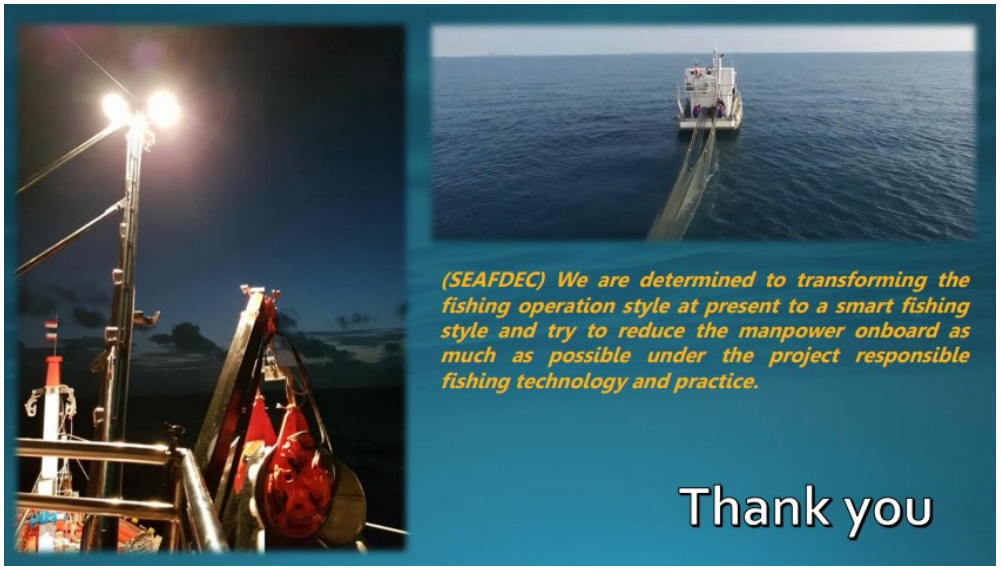
- Reduce slipping on the power block, up and down movements
- Improve safety working conditions, risk work onboard, and replacement of the traditional practices.
- Reduced crew number onboard. Adopt or innovate modern fishing fleet management in Thailand.

Fish Pump

Main benefits for Fish Pump

- Easy installation
- Up to 1,000 m3/h
- Low energy consumption
- Up to 20 m depth
- Easy ship to ship transfer
- Easy to be handle due to lightweight construction
- Lightweight & flexible discharge hose

Small scale fishery


(SEAFDEC) We are determined to transforming the fishing operation style at present to a smart fishing style and try to reduce the manpower onboard as much as possible under the project responsible fishing technology and practice.
Thank you

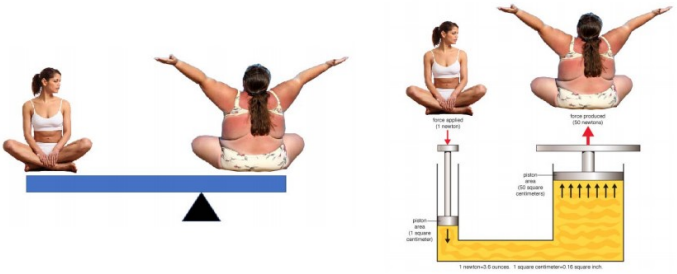
Appendix 5. Presentations in PowerPoint *(The Importance of Hydraulic system related to the fishing vessel)*

IMPORTANT OF HYDRAULIC SYSTEM FOR THE FISHING VESSELS

By M. Khunthawat

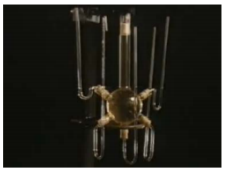
Online Regional Training Course Of Deck Machinery And Hauling Devices To Reduce Manpower In Fishing Vessels And Enhance Safety In Fishing Operations, May 5-6, 2021

Why small lady can left up heavier lady?



Mechanical Advantage

FUNDAMENTAL OF HYDRAULIC SYSTEM

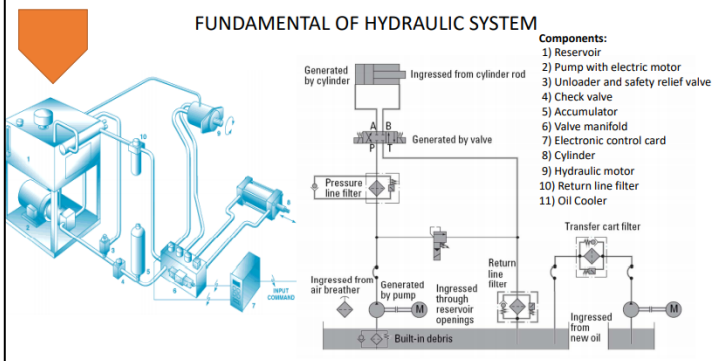


Incompressible fluid
Pressure, Speed

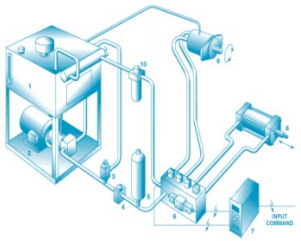
Lighter weight left
up heavier weight

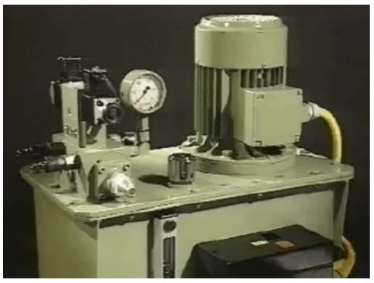
Lamina and turbulent
flow in pipe

FUNDAMENTAL OF HYDRAULIC SYSTEM

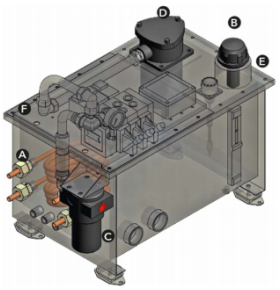


FUNDAMENTAL OF HYDRAULIC SYSTEM





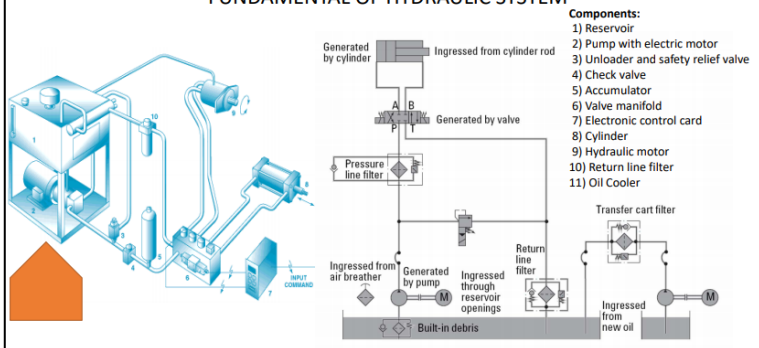
FUNDAMENTAL OF HYDRAULIC SYSTEM



Compact fuel oil tank

A – colling coil
B – Air breather
C – Hyd. Oil filter
D – Return oil filter
E – Hyd. Oil fill hold

FUNDAMENTAL OF HYDRAULIC SYSTEM



BASIC OPERATION OF HYDRAULIC COMPONENTS

Classification of Rotary Pumps:

Gear pumps
1. External gear pump
2. Internal gear pump
3. Lobe pump
4. Ge-rotor pump
5. Screw pump

Vane pumps
1. Unbalance vane pump
2. Balanced vane pump

Piston pumps
1. Axial piston pump
   (a) Straight axis piston pump
   (b) Bent axis piston pump
2. Radial piston pump
   (a) Stationary cylinder type
   (b) Rotating cylinder type

BASIC OPERATION OF HYDRAULIC COMPONENTS

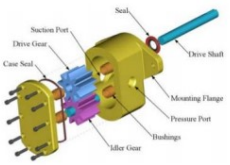
Classification of Rotary Pumps:

Gear pumps
1. External gear pump
2. Internal gear pump
3. Lobe pump
4. Ge-rotor pump
5. Screw pump

External Gear Pump:

Inside the displacement chambers, the oil inside the suction line is firstly transported from the suction side to the pressure side. This will generate a vacuum inside the suction line. When the vacuum increases, the fluid will be extracted from the tank into the suction line until it reaches the pump. The gear chambers will fill with oil and displace the oil around the outside to the pressure side. The combining of the great teeth will prevent the oil from flowing back.
Characteristics:

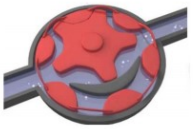
- Relatively high pressure of approx. 300 bar with small installation dimensions
- Low price
- Large speed range (500-6,000 rpm)
- Large temperature and viscosity range



Internal Gear Pump:

Liquid enters the suction port between the rotor (large exterior gear) and idler (small interior gear) teeth. Liquid travels through the pump between the teeth of the "gear-within-a-gear" principle. The crescent shape divides the liquid and acts as a seal between the suction and discharge ports. Intermeshing gears of the idler and rotor form locked pockets for the liquid which assures volume control. Rotor and idler teeth mesh completely to form a seal equidistant from the discharge and suction ports. This seal forces the liquid out of the discharge port. Characteristics:

- Constant even discharge regardless or pressure conditions
- Can be made to operate with one direction of flow with either rotation
- Low Net Positive Suction Head (NPSH) required
- Flexible design offers application customization

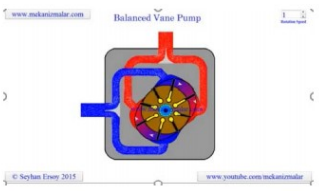


BASIC OPERATION OF HYDRAULIC COMPONENTS

Classification of Rotary Pumps:

Vane pumps

1. Unbalance vane pump
2. Balanced vane pump



Classification of Rotary Pumps:

Piston pumps

1. Axial piston pump
   (a) Straight axis piston pump
   (b) Bent axis piston pump
2. Radial piston pump
   (a) Stationary cylinder type
   (b) Rotating cylinder type

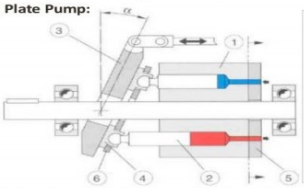
Axial Piston Pumps:

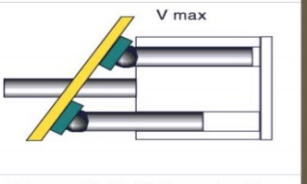
- Axial piston pumps are positive displacement pumps inside which the pistons are configured parallel to the rotary axis of a cylinder drum.
- They have a circular piston group which rotates against an angled swash plate.
- As the rotary group turns the pistons are pushed forwards and backwards, a grooved timing plate at the top of the piston which controlled fluid is drawn through the suction side of the pump and out through the pressure side.
- A fixed displacement piston pump has fixed swash plate but range of different controllers can be used to control the position of and adjustable swash plate to make a variable displacement version.
- Changing the angle of the swash plate will change the axial displacement of the pistons and therefore the flow from the pump. The angle of swash can be controlled manually although more commonly a constant pressure, flow or power control.
- Design: The bearing and piston feet have hydrostatic lubrication that requires a constant leak into the case. Draining leaking fluid and maintaining a low, stable pressure in the pump casing is important for ensuring a long pump life.
- Unlike gear pumps, piston pumps do not generate much contamination as they operate. But also piston pumps do not last as long if the fluid is dirty.

❑ Types of Axial piston pumps

Axial piston pumps are broadly classified as:

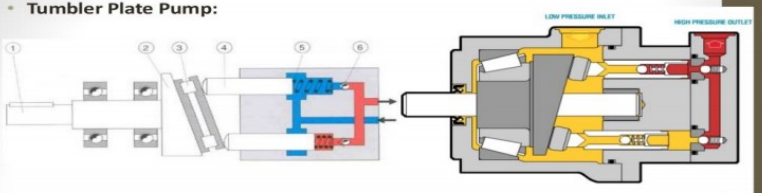
- **Angled Plate Pump:**





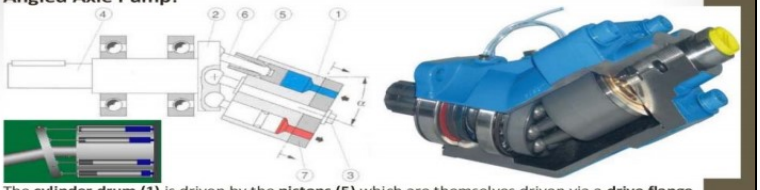
- The **cylinder drum(1)** is driven so that the **pistons(2)**, which are guided inside it, are also driven. The axial movements of the pistons are determined by an **angled plate(3)** inside the pump housing which can be tilted away from right-angle position to the drive axis.
- The pistons move along an elliptical orbit against the stationary angled plate (deflection plate). The generated friction is controlled by a **friction disk(4)** and the axial bearing. During the suction phase, the pistons move outwards while being held against the deflection plate by retainer devices. During the pressure phase, the pistons are forced inwards by the plate.
- The direction of oil flow for each piston, meaning either to a pressure or suction port, is governed by control slots. They are located in a **rigid control plate(5)** against which the free end of the cylinder drum will rotate.

- **Tumbler Plate Pump:**



- The **shaft (1)** drives a **tumbler plate (2)** which transmits its axial movement to a non-rotating pistons. The pistons are pressed via springs against the tumbler plate. The forces between the piston and the tumbler plate when pressing against each other are transmitted by an **axial bearing (3)**.
- The flow direction from each piston is governed either by **control valves (6)** or via control slots in each piston.
- The angle of the rotating tumbler plate cannot be changed, which means that the displacement volume of this type of pump remains constant.

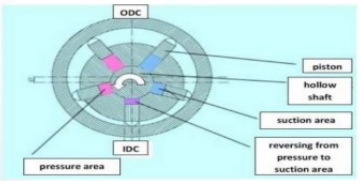
- **Angled Axle Pump:**



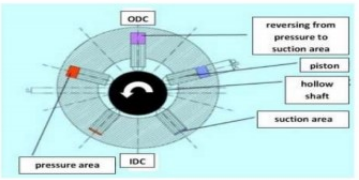
- The **cylinder drum (1)** is driven by the **pistons (5)** which are themselves driven via a **drive flange (2)**. The cylinder drum is guided either by a central trunnion or by a needle bearing around its circumference and it tilted away from the axis of the drive shaft. The displacement volume varies according to the deflection angle. This principle enables these pumps to run in reverse direction.
- The connection between the piston and drive flange is carried out by a **ball-joint (6)** which pulls the piston inside its cylinder during the suction phase and pushes the piston during the pressure phase. A further joint is necessary between the actual piston and ball-joint in order to equalise any circular or elliptical orbits.
- The suction and pressure side of the pump are divided, just like the angled plate principle, by a slotted plate. This **flat or spherical control plate (7)** deflects with the cylinder drum meaning that the pressure port must pass through the deflection bearing or be connected to the control plate via a sealed friction guide.

Radial Piston Pump

The working pistons extend in a radial direction symmetrically around the drive shaft, in contrast to the axial piston pump. The stroke of each piston is caused by an eccentric drive shaft or an external eccentric tappet. When filling the workspace of the pumping pistons from "inside" (e.g., over a hollow shaft) it is called an *Inside impinged* (but outside braced) radial piston pump. If the workspace is filled from "outside" it's called an *Outside impinged* radial piston pump (but inside braced).

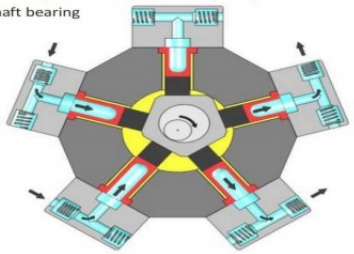


Inside Impinged Radial Piston Pump



Outside Impinged Radial Piston Pump

- **Working:**
  - The outer ring for bracing of the pumping pistons is in eccentric position to the hollow shaft in the center. This eccentricity determines the stroke of the pumping piston.
  - The piston starts in the inner dead center (IDC) with suction process. After a rotation angle of 180° it is finished and the workspace of the piston is filled with the to moved medium. The piston is now in the outer dead center (ODC). From this point on the piston displaces the previously sucked medium in the pressure channel of the pump.
- **Characteristics:**
  - very high load at lowest speed due to the hydrostatically balanced parts possible
  - no axial internal forces at the drive shaft bearing
  - high reliability
  - high efficiency
  - high pressure (up to 1,000 bar)
  - low flow and pressure ripple
  - low noise level



Selection criteria for hydraulic pump:

Pressure
Gear pumps : 35 to 200 bar
External gear pump : 130 – 200 bar
Internal gear pump : 35 – 135 bar
Vane pumps : 70 to 140 bar
Piston pumps : 140 to 850 bar
Axial piston pump : 135 – 800 bar
Radial piston pump : 200 – 800 bar

Speed
Gear pumps :
External gear pump : 1200 – 2500 rpm
Internal gear pump : 1200 – 2500 rpm
Vane pumps : 1200 – 1800 rpm
Piston pumps :
Axial piston pump : 1200 – 1800 rpm
Radial piston pump : 1200 – 3000 rpm

Discharge (rate of flow)
Gear pumps :
External gear pump : up to 33 m^3/hr
Internal gear pump : up to 45 m^3/hr
Vane pumps : up to 18 m^3/hr
Piston pumps :
Axial piston pump : up to 45 m^3/hr
Radial piston pump : up to 45 m^3/hr

Volumetric efficiency
Gear pumps :
External gear pump : 80 – 90 %
Internal gear pump : 70 – 85 %
Vane pumps : 80 – 95 %
Piston pumps :
Axial piston pump : 90 – 98 %
Radial piston pump : 85 – 95 %

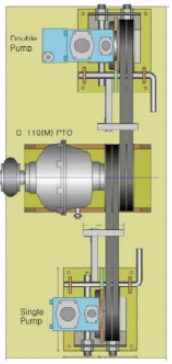
Selection criteria of oil for hydraulic pump:

Pump Type	Temp °C/°F max.	Pressure bar/psi	Viscosity ISO VG
Gear	70/158	34.5/500	32-68
	60/140	34.5/500	15-32
Vane	70/158	34.5/500	15-22
	70/158	69/1,000	22-46
	60/140	69/1,000	15-32
	40/104	69/1,000	10-15
Piston	70/158	34.5/500	15-22
	70/158	172.5/2,500	22-46
	60/140	172.5/2,500	32-46
	40/104	172.5/2,500	15-22
	70/158	293/4,250	46-68
	60/140	293/4,250	22-46
	40/104	293/4,250	15-22

SOURCE OF POWER UNITS

Engine

Electric Motor



SOURCE OF POWER UNITS

SOURCE OF POWER UNITS

ELECTROMAGNETIC CLUTCH AND PUMP ASSEMBLIES

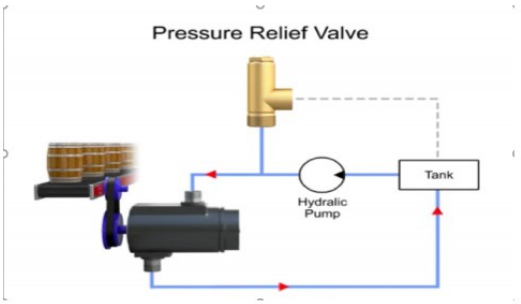
1,100 THB

DIRECT DRIVE BY ENGINE

REVERSIBLE HYDRAULIC MECHANICAL CLUTCH

DIRECT DRIVE BY ELECTRIC MOTOR

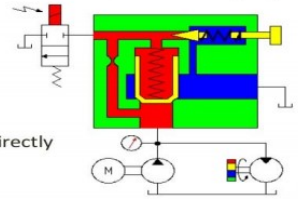
Direct Acting and Pilot Operated Pressure Relief Valve



❖ Pressure Valves

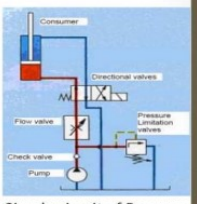
- "Pressure valves" is a general term for ALL valves that directly or indirectly influence a part of or the total system pressure inside a hydraulic system. This is carried out exclusively by **changing the throttle cross-section** by means of either mechanical, hydraulic or electrical control elements.
- When throttle cross-section is closed, all pressure valves can be divided into gate valves and seat valves in a similar way to directional valves. Pressure valves can be divided into sub-groups according to their functions:
  - **Pressure limitation valves (PLV)**
  - **Pressure switch-in valves**
  - **Pressure reduction valves (PRV)**
  - **Pressure cut-off valves**

NOTE: These valves can be either directly or pre-controlled.



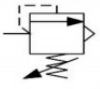
❑ Pressure limitation valves (PLV)

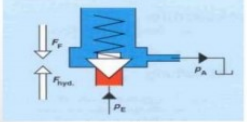
- A PLV has the task of limiting a pressure to a certain value. If the required pressure is exceeded, the PLV will be actuated and directs the excessive flow volume out of the hydraulic circuit back to the oil tank.
- According to its task it can also be called a *safety valve*. It is always located in a bypass line.
- Principle common to all pressure limitation valves is that the input pressure is guided onto a surface which is subjected to a force. As long as the spring force is higher than the force of pressure, the control element will remain on its seat. If the force of the pressure exceeds the spring force, the excessive hydraulic fluid will be directed back to the tank. When flowing back to the tank, the hydraulic energy inside the fluid will be transformed into heat.



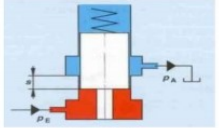
Simple circuit of Pressure Limitation valve

Symbol:





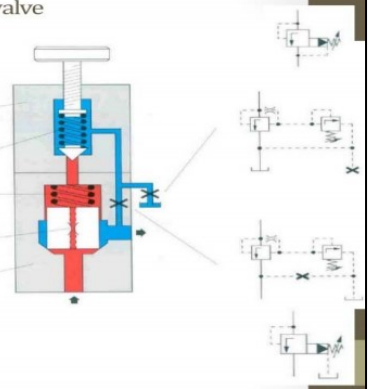
Seat Valve



Gate Valve

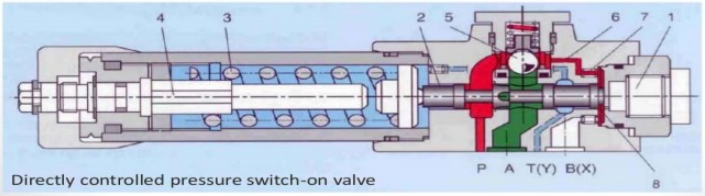
Pre-controlled pressure limitation valve

- Pre-controlled pressure limitation valve consists of a main (1) and a pre-control stage (2), whereby the latter involves a simple pressure limitation valve of seat design.
- It is a measuring unit within a system because the setting of its spring (3) is decisive for the actuation pressure of the total valve. The input pressure reaches the lower end of the valve and, via a throttle (4), to the upper end. From here, there is a connection to the pre-control valve. As long as this valve is not actuated, the pressure is balanced and its closed switching position can be maintained by the relatively weak spring (5).
- When the opening pressure is achieved at the input of the of the valve, a small control pressure will flow through the throttle and the pre-control valve. This will generate a pressure drop at the throttle - therefore a force difference between the upper and lower ends of the valve - which will cause the throttle to be forced upwards against its spring and open a connection between the input and the output.



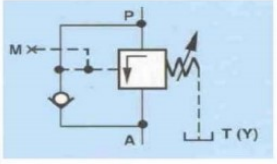
Pressure switch-on valves

- Pressure switch-on valves are installed in the main flow of a hydraulic system and are actuated when a certain pressure is achieved to switch on another hydraulic system.
- It is possible to use pressure limitation valves as a replacement for pressure switch-on valves. A requirement for this is that the pressure inside channel T (with directly controlled PLV) or inside channel B (with pre-controlled PLV) cannot change the pre-selected pressure setting.
- This can be achieved when the leakage oil of a directly controlled pressure limitation valve, or the control oil of a pre-controlled pressure limitation valve, is returned externally to the hydraulic tank.
- Settings of the switch-on pressure are carried out on the adjuster element (4). The compression spring (3) will hold the control piston (2) at starting position. The valve is closed.

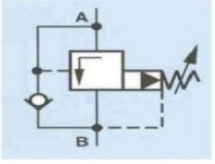


Directly controlled pressure switch-on valve

- The pressure inside channel P passes through the control line (6) and is active on surface (8) of control piston (2), therefore against the spring force (3). If the pressure in channel P exceeds the value of the spring, the control piston (2) will be forced away against the spring (2). The connection between channel P and channel A is opened. The hydraulic system connected to channel A will be switched in without any pressure loss in channel P.
- The control signal is received internally via the control line (6) and the nozzle (7) from channel P, or externally via connection B (X). Depending on the application, the leakage oil is returned via connection T (Y), or internally via connection A. In order to ensure an unrestricted return flow from channel A to channel P, it is possible to install a check valve. The manometer connection (1) is designed to check the switch-on pressure.



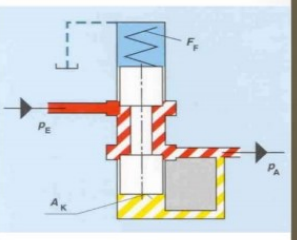
Directly controlled pressure switch-on valve with internal control oil input and external control oil output



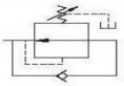
Pre-controlled pressure cut-off valve with internal control oil input and external control oil output

❑ Pressure reduction valves

- Contrary to pressure limitation valves, pressure reduction valves have the task of reducing the input pressure in certain sections of a hydraulic system. The reduction of the input pressure (primary pressure) and maintaining the output pressure (secondary pressure) is carried out at a value which is lower than the value of the pressure inside the main hydraulic circuit. It is therefore possible to use a pressure reduction valve to reduce the pressure inside a certain section of a hydraulic system.
- In order to reduce and maintain the output pressure at a certain level, the pressure input pressure works against the end of the control valve (piston or cone) where it is compared with the force of the regulation spring. If the hydraulic force pA * AK exceeds the spring force, the piston will move upwards towards closing position. While regulating, the control gate is in a balance of pressure. The average cross-section that is necessary to hold pA at a constant value is regulated according to the flow volume Q and input pressure pE.

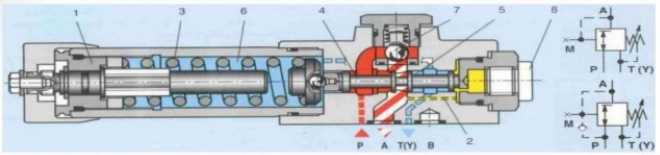


Symbol:



Pressure-Reducing Valve

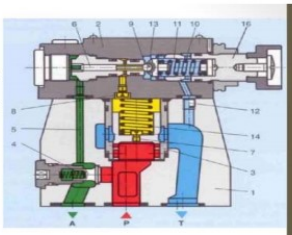
In principle, directly controlled pressure reduction valves are produced in 3-way design, meaning that the pressure safeguarding of the secondary circuit is carried out via the adjuster element. The design of the adjuster element can vary according to the customer or application requirements.



- The valve is open at starting position; meaning that the flow volume can flow unrestricted from channel P to channel A. The pressure in channel A is simultaneously active via the control line (2) and the piston surface against the spring (3). When the pressure inside channel A increases above the pressure value of the spring (3), the control piston (4) will move to regulation position in order to hold a constant pressure inside channel A. The signal and control flow volume is monitored internally via the control line (2) from channel A.
- If the pressure increases in channel A due to external influences on a consumer, the control piston (4) will adjust even further against the spring (3). Channel A will then be connected to the tank via the control edge (5) of the control piston (4). The necessary quantity of fluid will flow back to the tank to prevent the pressure from increasing.
- The leakage oil will flow out of the spring chamber (6) via channel T(Y). If required, a check valve can be installed to allow the fluid to flow freely back from channel A to channel P. The manometer connection (8) is designed to monitor the reduced pressure.

❑ Pressure cut-off valves

- Pressure cut-off valves, also known as reservoir charging valves, are mainly used in hydraulic systems equipped with a pressure reservoir. Their task is to switch over the flow volume to pressure-free circulation when the pressure reservoir has achieved its nominal pressure. Pressure cut-off valves are also used in hydraulic systems equipped with high-pressure and low-pressure pumps (twin circuit systems). In this case, the low-pressure is switched over to pressure-free circulation when the pressure range of the high-pressure has been achieved.



- A pressure cut-off valve mainly consists of a main valve (1) with a main piston unit (3), a pre-controlled valve (2) with a pressure adjuster element (16) and a check valve (4). With valves of nominal size 10, the check valve is installed in the main valve. With valves exceeding nominal size 10, the check is located in a separate intermediate plate.
- The hydraulic pumps feed the flow volume via the check valve (4) in the hydraulic system. The pressure in channel A passes through control line (5) to the control piston (6). At the same time, the pressure is active in channel P via the nozzles (7) and (8) on the spring-loaded side of the main piston (3) and the ball (9) inside the pre-control valve. As soon the pre-selected cut-off pressure of the pre-controlled valve is achieved, the ball will move from its seat against the spring (10). The fluid will then flow via the nozzles (7) and (8) into the spring chamber (11). From here, the fluid flows internally or externally via the control line (12) and channel T back to the tank.

Check Valves

Symbol:

- The function of check valves in a hydraulic system is to **stop** the **flow** of hydraulic fluid **in one direction** and to **allow** its flow **in** the **other direction**. This is why check valves are also known as **non-return valves**.
- They function without causing a flow of leakage oil. Their shut-off elements can consist of either balls, plates, cones or cones with shaft seals.
- Technical terminologies used:
  - **Cracking pressure** - the inlet pressure at which the first indication of flow occurs (the *minimum upstream pressure at which the valve will operate*).
  - **Reseal pressure** - the pressure at which there is no indication of flow.
  - **Back pressure** - the differential pressure between the inlet and outlet pressures.

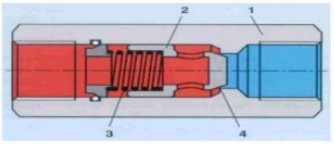
Check valves can be divided into different groups according to their applications:

- Check valves
  - Simple check valves
  - Hydr. releaseable check valves
  - Filler valves

NOTE: Ball shut-off elements are economical to produce but cone shut-off elements are more efficient and have longer life.

Simple check valves

Symbol:



- This valve consists of a **housing (1)** and a hardened **piston (2)** which is forced by a **spring (3)** against a **seat (4)**. When fluid flows in the required direction, the fluid pressure will force the piston cone away from its seat to allow the fluid to pass through. *If the fluid flows in the other direction, the spring and fluid pressure will force the piston cone against its seat and stop the flow of fluid.*

→ Reverse
← Free Passage

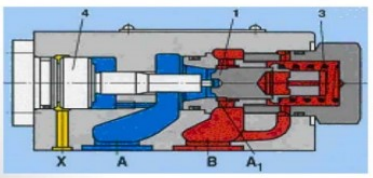
- The **cracking pressure** of the check valve depends on the force of the spring and therefore cannot be influenced externally. Depending on their applications, the pre-tension of these springs can be between 0.5 bar and 5.0 bar. If the check valve is not equipped with a spring, it must always be installed vertically so that the *weight of its internal closing element determines its cracking pressure*.
- Important nominal values for check valves are the **nominal size (6 - 150)**, **flow volume (up to 15000 l/min)**, **operational pressure (up to 315 bar)** and the **cracking pressure without a spring (0.5, 1.5, 3.0 or 5.0 bar)**.
- Applications:
  - To **bypass throttle**
  - To **stop flow direction**
  - As bypass valve to **bypass a return flow filter after a certain back-pressure is achieved to contamination**.

Hydraulic releasable check valves

- Contrary to simple check valves, the **non-flow direction** of releasable check valves **can be controlled**.
- Applications:
  - to hold the pressure inside operational circuits
  - to secure raised components against lowering in the event of a pipe fracture
  - to prevent creeping movements of involved consumers
- Types:
  - Releasable check valves **without leakage oil connection**
  - Releasable check valves **with leakage oil connection**

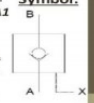
- Nominal size: **6-150**
- Flow volume up to **6400l/min** (approx.)
- Operation pressure up to **315 bar**

Releasable check valves without leakage oil connection (valve type **SV**):



- In **SV** type the free volume flows from **A to B**. The *fluid is active on **surface A1** of the **main cone (1)** and forces it against the **spring (3)** away from its seat*. With a volume flow from B to A, the flow is interrupted according to a normal check valve.
- The *flow release in direction B to A is carried via the **control piston (4)***. The necessary control oil pressure coming from connection X will move the control piston to the right to open the main cone (1).

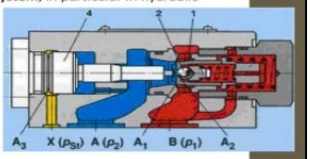
Symbol:



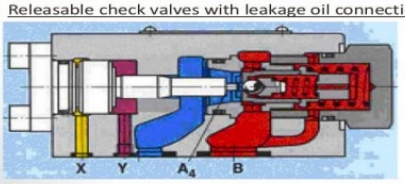
- The necessary control pressure equals the surface area ratio between surface A1 and the opening control piston. *This ratio is usually* ***1:3***.
- The total cross-section of surface A is instantly opened during the opening function. This could result in pressure relief impacts, particularly when large volumes under pressure are released. Such **relief impacts not only produce noise, they also create peak loads in the total hydraulic system**; in particular in hydraulic connectors and moving parts.

In applications where these relief impacts are not compensated, the valve goes through a pre-opening phase

- When control connection X is subjected to pressure, the control piston (4) firstly forces the pre-opening ball (2) away before forcing the main cone (1) from its seat.
- The pre-opening ball uncovers only a small cross-section. This enables the cylinder to extend slowly before the main cones moves and uncovers the total cross-section. **Such designs enables dampened pressure relief of the pressurized fluid**.

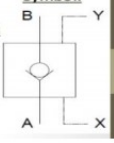


- Releasable check valves with leakage oil connection (valve type SL):



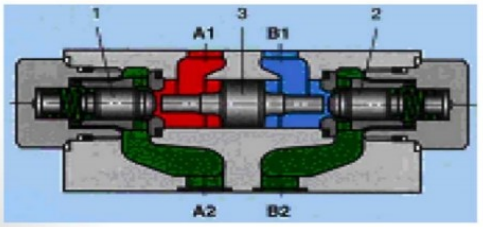
- The difference to valve type **SV** is the **additional leakage oil connection Y**.
- The ring surface of the control piston is separated from connection A.
- Any **pressure at connection A** is only **active on** surface **A4** of the control piston.

Symbol:

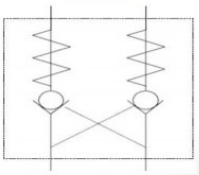


Twin check valves

- Twin or double check valves are created by assembling two releasable check valves (1 and 2) inside one valve housing.
- In flow direction A1 to A2 or B1 to B2 the fluid flow is unrestricted, and in flow direction A2 to A1 or B2 to B1 the fluid flow is interrupted.
- When, for examples, the fluid flows through the valve from A1 to A2, the control piston (3) is move by the pressure to the right and pushes the cone (2) of the check valve against its seat. Unrestricted flow is now possible from B1 to B2. This procedure functions in the same manner when fluid flows from B1 to B2.

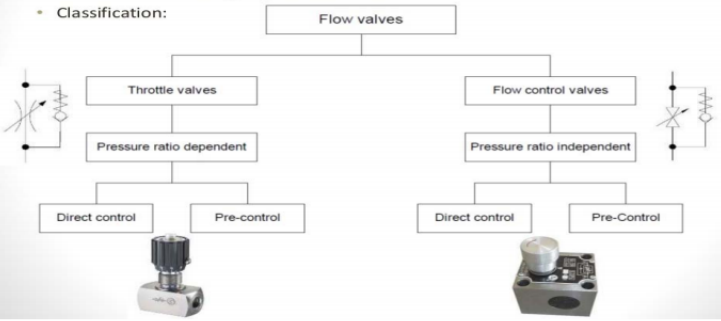


Symbol:



Flow Valves

- Flow valves are designed to alter (increase or decrease) their throttle cross-sections and thereby influence movement speeds of consumers. A flow distributor has a special function in that is divides an incoming flow volume into two or more outgoing flow volumes.
- Classification:

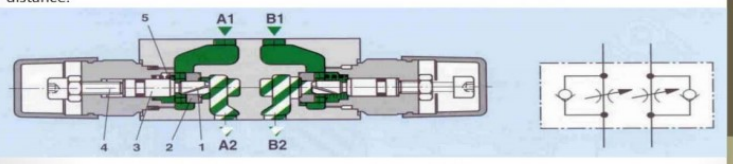


❑ Throttle Valves

The flow volume of throttle valves depends on the difference of pressure; which means that a larger pressure difference will result in a larger flow volume. In numerous control systems where a constant speed is not decisive, throttles are used because flow regulation valves would be too expensive for such purposes. Throttle valves are used when:

- A constant working resistance is available.
- A speed change with a fluctuating load is not important or can be disregarded.

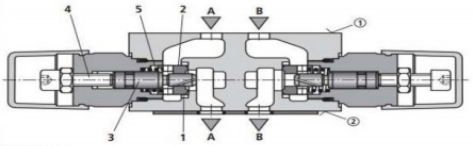
When the throttle distance is shorter, a change of viscosity will have less influence. It should be noted that the flow volume will increase as the fluid viscosity decreases. Whether a valve is dependent or not dependent on the fluid viscosity, this depends on the design of the throttle distance.



1 – Throttle Unit
2 – Valve Seat
3 – Throttle Piston
4 – Adjuster Screw

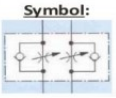
- The fluid in channel A reaches consumer A2 via the throttle unit (1) consisting of the valve seat (2) and the throttle piston (3). The throttle piston (3) can be axially adjusted via the adjuster screw (4) in order to adjust the throttle cross-section (1).
- The fluid returning from consumer B2 will force the valve seat against the spring (5) in the direction of the throttle piston (3) to enable an unrestricted return flow. Depending on its installation configuration, the throttling effect will take place in the feed or return flow direction.
  - **Twin throttle check valves**

    In order to alter the speed of a consumer (main flow limitation), a twin throttle check valve is installed between the directional valve and the connection plate. With pre-controlled directional valves, the twin throttle check valve can be utilized to set the switching time (control flow limitation). It is then installed between the pre-control valve and main valve.



1 – Throttling point
2 – Valve seat
3 – Throttle spool
4 – Setscrew
① - Component side
② - Plate side

Symbol:



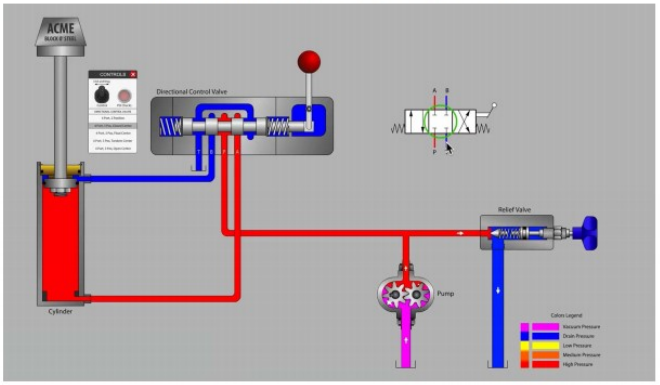
Hydraulic directional control valves

Monoblock hydraulic directional control valve

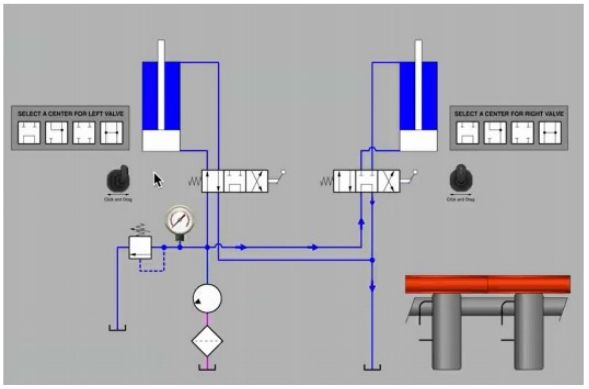
Electrical directional control valve

Electro-hydraulic operated directional control valve

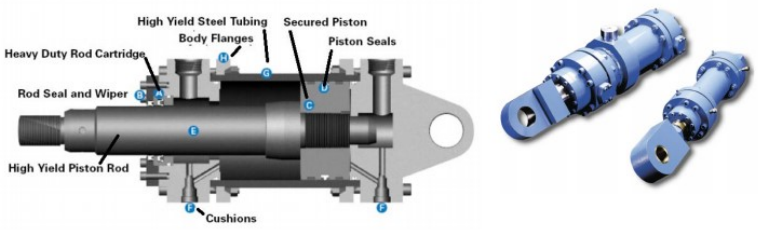
HYDRAULIC DIRECTIONAL CONTROL VALVE

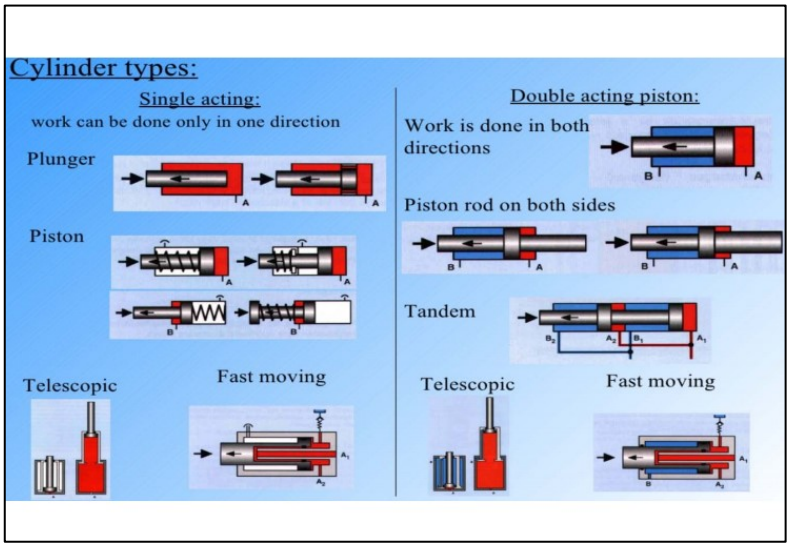


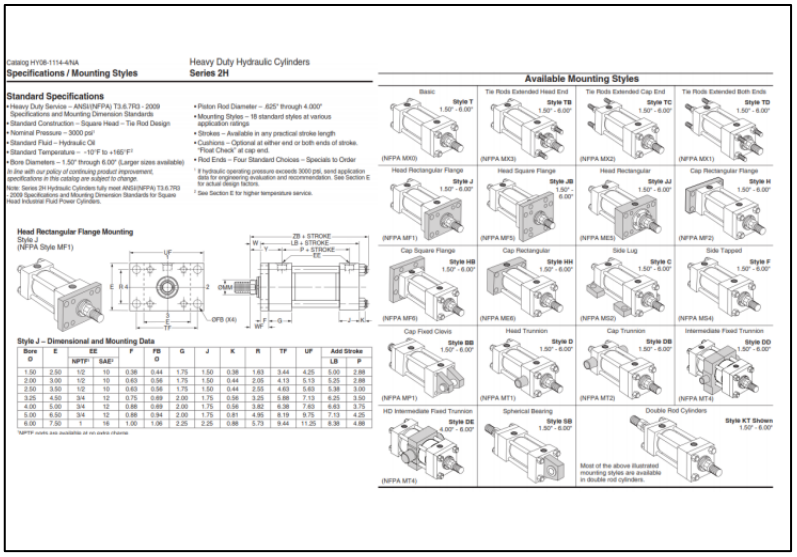
HYDRAULIC DIRECTIONAL CONTROL VALVE



Actuators (Cylinder)



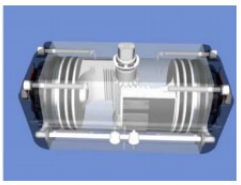




*Hydraulic Motors

- A hydraulic motor is a mechanical actuator that converts hydraulic pressure and flow into torque and angular displacement (rotation).
- Conceptually, a hydraulic motor should be interchangeable with a hydraulic pump because **it performs the opposite function** but most hydraulic pumps cannot be used as hydraulic motors because they cannot be back driven.
- Only very few hydraulic motors can cover a speed range from very slow to over 1000 rpm. Therefore, hydraulic motors can be divided into **fast-running types (n = 500 to 10000 rpm)** and **slow-running types (n = 0.5 to 1000 rpm)**.
- The performance of a hydraulic motor depends on its flow volume and the pressure difference inside the motor; its performance is proportional to its rotation speed.
- Hydraulic motors usually have a drain connection for the internal leakage, which means that when the power unit is turned off the hydraulic motor in the drive system will move slowly if an external load is acting on it. Thus, for applications such as a crane or winch with suspended load, there is always a need for a brake or a locking device.

ACTUATOR (MOTOR)



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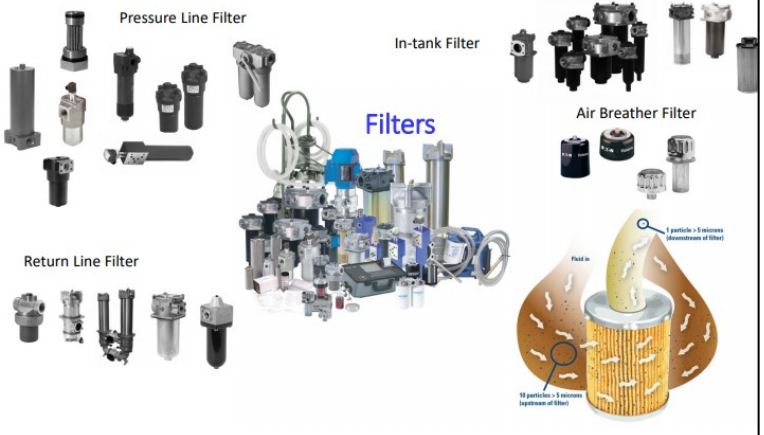


ELEMENTS OF HYDRAULIC FILTER

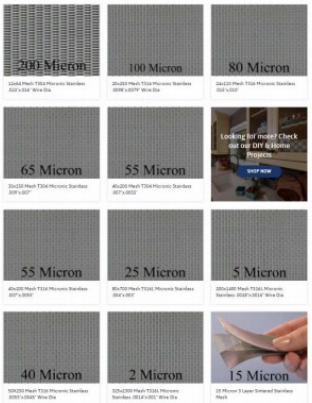
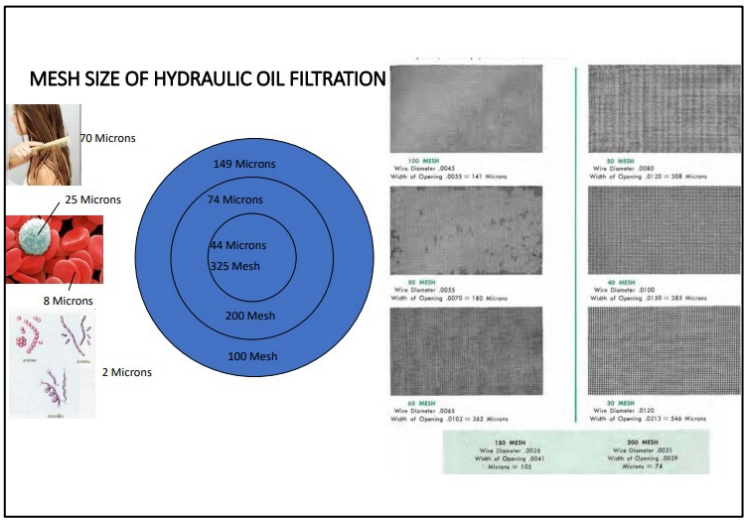
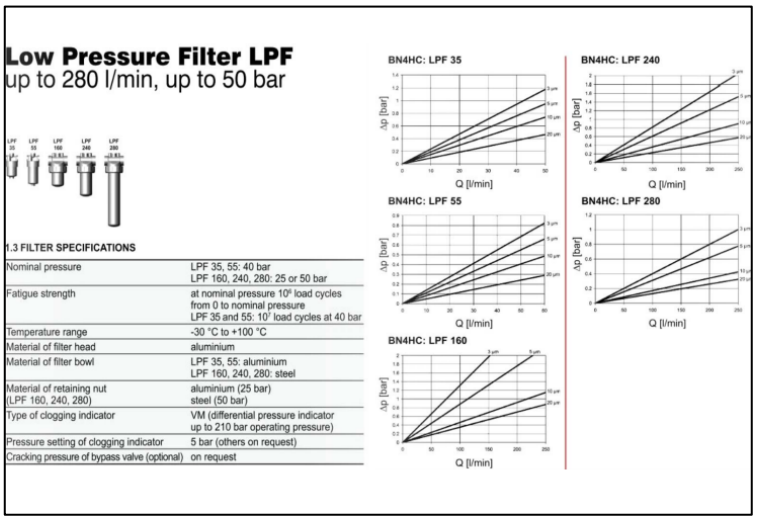


Table II — Filter Element Media Numbers

Number	Nom. Microns	Filter Element Media
1220	74	200 Mesh Stainless Steel
1215	105	150 Mesh Stainless Steel
1210	141	100 Mesh Stainless Steel
1208	180	80 Mesh Stainless Steel
1206	262	60 Mesh Stainless Steel
1205	308	50 Mesh Stainless Steel
1204	385	40 Mesh Stainless Steel
1203	546	30 Mesh Stainless Steel
1202	914	20 Mesh Stainless Steel
2210	10	8-10 Micron Stainless Steel
2215	15	10-15 Micron Stainless Steel
2225	25	25 Micron Stainless Steel
2240	40	40 Micron Stainless Steel
7103	3	3 Micron Paper
7110	10	10 Micron Paper
7120	20	20 Micron Paper
7203**	3	3 Micron Paper Mesh Inside
7210**	10	10 Micron Paper Mesh Inside
7220**	20	20 Micron Paper Mesh Inside
7303**	3	3 Micron Paper Mesh Outside
7310**	10	10 Micron Paper Mesh Outside
7320**	20	20 Micron Paper Mesh Outside



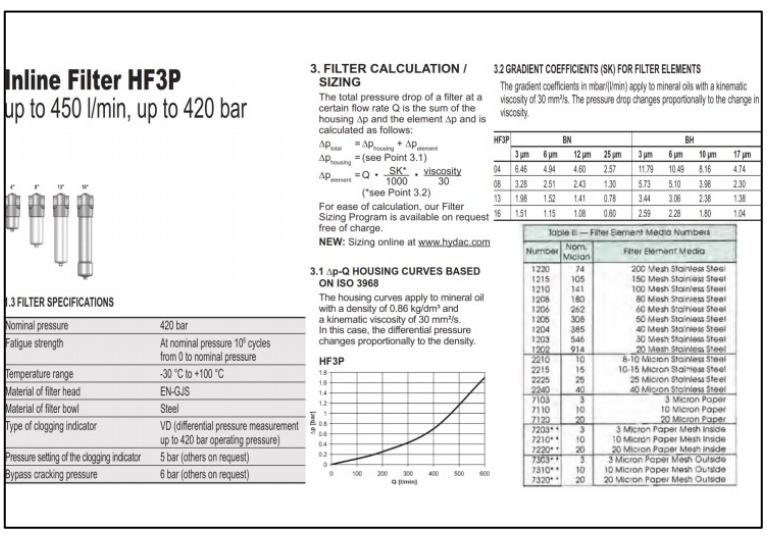


Low Pressure Filter LPF
up to 280 l/min, up to 50 bar

1.3 FILTER SPECIFICATIONS

Nominal pressure	LPF 35, 55: 40 bar LPF 160, 240, 280: 25 or 50 bar
Fatigue strength	at nominal pressure 10^6 load cycles from 0 to nominal pressure LPF 35 and 55: 10^7 load cycles at 40 bar
Temperature range	-30 °C to +100 °C
Material of filter head	aluminium
Material of filter bowl	LPF 35, 55: aluminium LPF 160, 240, 280: steel
Material of retaining nut (LPF 160, 240, 280)	aluminium (25 bar) steel (50 bar)
Type of clogging indicator	VM (differential pressure indicator up to 210 bar operating pressure)
Pressure setting of clogging indicator	5 bar (others on request)
Cracking pressure of bypass valve (optional)	on request

BN4HC: LPF 35
BN4HC: LPF 240
BN4HC: LPF 55
BN4HC: LPF 280
BN4HC: LPF 160
Δp [bar]
Q [l/min]



Inline Filter HF3P
up to 450 l/min, up to 420 bar

1.3 FILTER SPECIFICATIONS

Nominal pressure	420 bar
Fatigue strength	At nominal pressure 10^6 cycles from 0 to nominal pressure
Temperature range	-30 °C to +100 °C
Material of filter head	EN-GJS
Material of filter bowl	Steel
Type of clogging indicator	VD (differential pressure measurement up to 420 bar operating pressure)
Pressure setting of the clogging indicator	5 bar (others on request)
Bypass cracking pressure	6 bar (others on request)

3. FILTER CALCULATION / SIZING

The total pressure drop of a filter at a certain flow rate Q is the sum of the housing Δp and the element Δp and is calculated as follows:

$\Delta p_{total} = \Delta p_{housing} + \Delta p_{element}$

$\Delta p_{housing} =$ (see Point 3.1)

$\Delta p_{element} = Q \cdot \frac{SK^*}{1000} \cdot \frac{viscosity}{30}$

(*see Point 3.2)

For ease of calculation, our Filter Sizing Program is available on request free of charge.

NEW: Sizing online at www.hydac.com

3.1 Δp-Q HOUSING CURVES BASED ON ISO 3968

The housing curves apply to mineral oil with a density of 0.86 kg/dm³ and a kinematic viscosity of 30 mm²/s. In this case, the differential pressure changes proportionally to the density.

HF3P

Δp [bar]
Q [l/min]

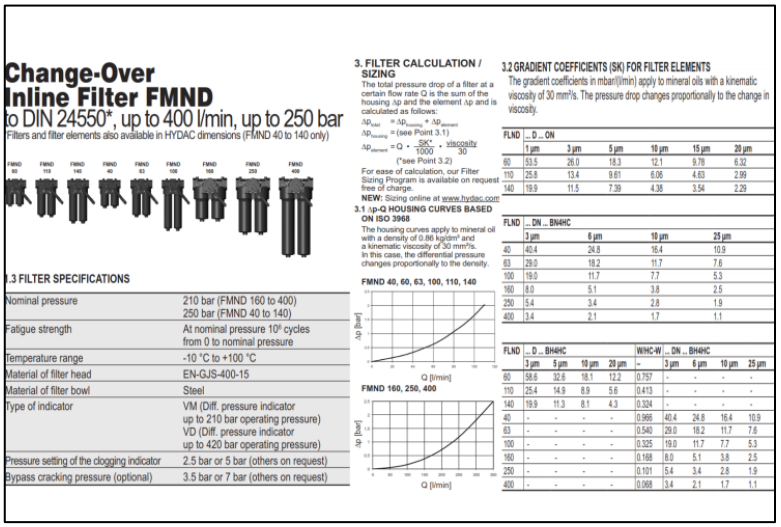
3.2 GRADIENT COEFFICIENTS (SK) FOR FILTER ELEMENTS

The gradient coefficients in mbar/(l/min) apply to mineral oils with a kinematic viscosity of 30 mm²/s. The pressure drop changes proportionally to the change in viscosity.

HF3P	BN				BH			
	3 µm	6 µm	12 µm	25 µm	3 µm	6 µm	10 µm	17 µm
04	6.46	4.94	4.60	2.57	11.79	10.49	8.16	4.74
08	3.28	2.51	2.43	1.30	5.73	5.10	3.98	2.30
13	1.98	1.52	1.41	0.78	3.44	3.06	2.38	1.38
16	1.51	1.15	1.08	0.60	2.59	2.28	1.80	1.04

Table 8 — Filter Element Media Numbers

Number	Nom. Micron	Filter Element Media
1220	74	200 Mesh Stainless Steel
1215	105	150 Mesh Stainless Steel
1210	141	100 Mesh Stainless Steel
1208	180	80 Mesh Stainless Steel
1206	262	60 Mesh Stainless Steel
1205	306	50 Mesh Stainless Steel
1204	385	40 Mesh Stainless Steel
1203	546	30 Mesh Stainless Steel
1202	914	20 Mesh Stainless Steel
2210	10	8-10 Micron Stainless Steel
2215	15	10-15 Micron Stainless Steel
2225	25	25 Micron Stainless Steel
2240	40	40 Micron Stainless Steel
7103	3	3 Micron Paper
7110	10	10 Micron Paper
7120	20	20 Micron Paper
7203**	3	3 Micron Paper Mesh Inside
7210**	10	10 Micron Paper Mesh Inside
7220**	20	20 Micron Paper Mesh Inside
7303**	3	3 Micron Paper Mesh Outside
7310**	10	10 Micron Paper Mesh Outside
7320**	20	20 Micron Paper Mesh Outside



Change-Over Inline Filter FMND

to DIN 24550*, up to 400 l/min, up to 250 bar

Filters and filter elements also available in HYDAC dimensions (FMND 40 to 140 only)

1.3 FILTER SPECIFICATIONS

Nominal pressure	210 bar (FMND 160 to 400) 250 bar (FMND 40 to 140)
Fatigue strength	At nominal pressure 10^6 cycles from 0 to nominal pressure
Temperature range	-10 °C to +100 °C
Material of filter head	EN-GJS-400-15
Material of filter bowl	Steel
Type of indicator	VM (Diff. pressure indicator up to 210 bar operating pressure) VD (Diff. pressure indicator up to 420 bar operating pressure)
Pressure setting of the clogging indicator	2.5 bar or 5 bar (others on request)
Bypass cracking pressure (optional)	3.5 bar or 7 bar (others on request)

3. FILTER CALCULATION / SIZING

The total pressure drop of a filter at a certain flow rate Q is the sum of the housing Δp and the element Δp and is calculated as follows:

$\Delta p_{total} = \Delta p_{housing} + \Delta p_{element}$

$\Delta p_{housing}$ = (see Point 3.1)

$\Delta p_{element} = Q \cdot \frac{SK}{1000} \cdot \frac{viscosity}{30}$

(*see Point 3.2)

For ease of calculation, our Filter Sizing Program is available on request free of charge.

NEW: Sizing online at www.hydac.com

3.1 Δp-Q HOUSING CURVES BASED ON ISO 3968

The housing curves apply to mineral oil with a density of 0.86 kg/dm³ and a kinematic viscosity of 30 mm²/s. In this case, the differential pressure changes proportionally to the density.

FMND 40, 60, 63, 100, 110, 140

FMND 160, 250, 400

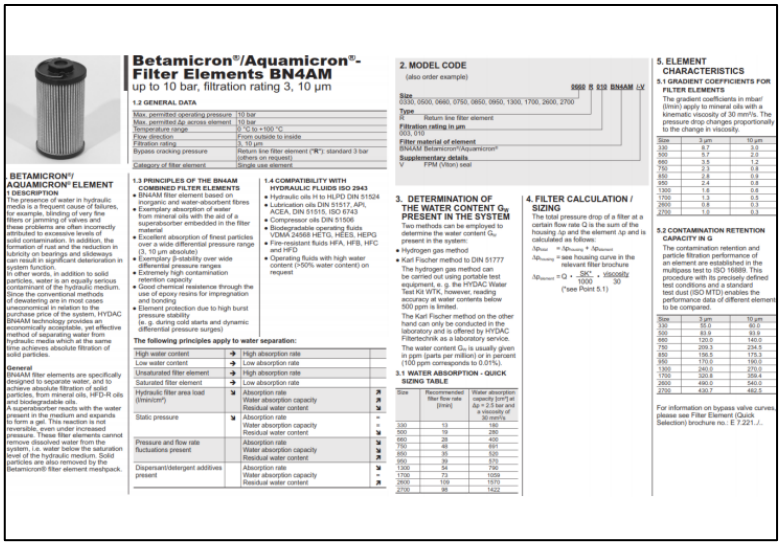
3.2 GRADIENT COEFFICIENTS (SK) FOR FILTER ELEMENTS

The gradient coefficients in mbar/(l/min) apply to mineral oils with a kinematic viscosity of 30 mm²/s. The pressure drop changes proportionally to the change in viscosity.

FLND	...D...ON					
	1 µm	3 µm	5 µm	10 µm	15 µm	20 µm
60	53.5	26.0	18.3	12.1	9.78	6.32
110	25.8	13.4	9.61	6.06	4.63	2.99
140	19.9	11.5	7.39	4.38	3.54	2.29

FLND	...DN...BN4HC			
	3 µm	6 µm	10 µm	25 µm
40	40.4	24.8	16.4	10.9
63	29.0	18.2	11.7	7.6
100	19.0	11.7	7.7	5.3
160	8.0	5.1	3.8	2.5
250	5.4	3.4	2.8	1.9
400	3.4	2.1	1.7	1.1

FLND	...D...BH4HC				WHC-W/...DN...BH4HC				
	3 µm	5 µm	10 µm	20 µm	–	3 µm	6 µm	10 µm	25 µm
60	58.6	32.6	18.1	12.2	0.757				
110	25.4	14.9	8.9	5.6	0.413	-	-	-	-
140	19.9	11.3	8.1	4.3	0.324	-	-	-	-
40	-	-	-	-	0.966	40.4	24.8	16.4	10.9
63	-	-	-	-	0.540	29.0	18.2	11.7	7.6
100	-	-	-	-	0.325	19.0	11.7	7.7	5.3
160	-	-	-	-	0.188	8.0	5.1	3.8	2.5
250	-	-	-	-	0.101	5.4	3.4	2.8	1.9
400	-	-	-	-	0.068	3.4	2.1	1.7	1.1



Betamicron®/Aquamicron®-Filter Elements BN4AM

up to 10 bar, filtration rating 3, 10 µm

BETAMICRON®/ AQUAMICRON® ELEMENT

1 DESCRIPTION

The presence of water in hydraulic media is a frequent cause of failures, for example, blinding of very fine filters or jamming of valves and these problems are often incorrectly attributed to excessive levels of solid contamination. In addition, the formation of rust and the reduction in lubricity on bearings and slideways can result in significant deterioration in system function.

In other words, in addition to solid particles, water is an equally serious contaminant of the hydraulic medium. Since the conventional methods of dewatering are in most cases uneconomical in relation to the purchase price of the system, HYDAC BN4AM technology provides an economically acceptable, yet effective method of separating water from hydraulic media which at the same time achieves absolute filtration of solid particles.

General

BN4AM filter elements are specifically designed to separate water, and to achieve absolute filtration of solid particles, from mineral oils, HFD-R oils and biodegradable oils.

A superabsorber reacts with the water present in the medium and expands to form a gel. This reaction is not reversible, even under increased pressure. These filter elements cannot remove dissolved water from the system, i.e. water below the saturation level of the hydraulic medium. Solid particles are also removed by the Betamicron® filter element meshpack.

1.2 GENERAL DATA

Max. permitted operating pressure	10 bar
Max. permitted Δp across element	10 bar
Temperature range	-5 °C to +100 °C
Flow direction	From outside to inside
Filtration rating	3, 10 µm
Bypass cracking pressure	Return line filter element ("R"): standard 3 bar (others on request)
Category of filter element	Single use element

1.3 PRINCIPLES OF THE BN4AM COMBINED FILTER ELEMENTS

- BN4AM filter element based on inorganic and water-absorbent fibres
- Exemplary absorption of water from mineral oils with the aid of a superabsorber embedded in the filter material
- Excellent absorption of finest particles over a wide differential pressure range (3, 10 µm absolute)
- Exemplary β-stability over wide differential pressure ranges
- Extremely high contamination retention capacity
- Good chemical resistance through the use of epoxy resins for impregnation and bonding
- Element protection due to high burst pressure stability (e. g. during cold starts and dynamic differential pressure surges)

1.4 COMPATIBILITY WITH HYDRAULIC FLUIDS ISO 2943

- Hydraulic oils H to HLPD DIN 51524
- Lubrication oils DIN 51517, API, ACEA, DIN 51515, ISO 6743
- Compressor oils DIN 51506
- Biodegradable operating fluids VDMA 24568 HETG, HEES, HEPG
- Fire-resistant fluids HFA, HFB, HFC and HFD
- Operating fluids with high water content (>50% water content) on request

The following principles apply to water separation:

High water content	→	High absorption rate
Low water content	→	Low absorption rate
Unsaturated filter element	→	High absorption rate
Saturated filter element	→	Low absorption rate
Hydraulic filter area load	↘	Absorption rate ↗ Water absorption capacity ↗ Residual water content ↘
Static pressure	↘	Absorption rate = Water absorption capacity = Residual water content ↘
Pressure and flow rate fluctuations present		Absorption rate ↘ Water absorption capacity ↘ Residual water content ↗
Dispersant/detergent additives present		Absorption rate ↘ Water absorption capacity = Residual water content ↗

2. MODEL CODE

(also order example)

0660 R 010 BN4AM /-V

Size
0330, 0500, 0660, 0750, 0850, 0950, 1300, 1700, 2600, 2700

Type
R Return line filter element

Filtration rating in µm
003, 010

Filter material of element
BN4AM Betamicron®/Aquamicron®

Supplementary details
V FPM (Viton) seal

3. DETERMINATION OF THE WATER CONTENT G_{sw} PRESENT IN THE SYSTEM

Two methods can be employed to determine the water content G_{sw} present in the system:

- Hydrogen gas method
- Karl Fischer method to DIN 51777

The hydrogen gas method can be carried out using portable test equipment, e. g. the HYDAC Water Test Kit WTK, however, reading accuracy at water contents below 500 ppm is limited.

The Karl Fischer method on the other hand can only be conducted in the laboratory and is offered by HYDAC Filtertechnik as a laboratory service.

The water content G_{sw} is usually given in ppm (parts per million) or in percent (100 ppm corresponds to 0.01%).

3.1 WATER ABSORPTION - QUICK SIZING TABLE

Size	Recommended filter flow rate [l/min]	Water absorption capacity [cm³] at Δp = 2.5 bar and a viscosity of 30 mm²/s
330	53	180
500	79	280
660	26	400
750	48	691
850	35	520
950	39	570
1300	54	790
1700	73	1059
2600	109	1570
2700	98	1422

4. FILTER CALCULATION / SIZING

The total pressure drop of a filter at a certain flow rate Q is the sum of the housing Δp and the element Δp and is calculated as follows:

$\Delta p_{total} = \Delta p_{housing} + \Delta p_{element}$

$\Delta p_{housing}$ = see housing curve in the relevant filter brochure

$\Delta p_{element} = Q \cdot \frac{SK}{1000} \cdot \frac{viscosity}{30}$

(*see Point 5.1)

5. ELEMENT CHARACTERISTICS

5.1 GRADIENT COEFFICIENTS FOR FILTER ELEMENTS

The gradient coefficients in mbar/(l/min) apply to mineral oils with a kinematic viscosity of 30 mm²/s. The pressure drop changes proportionally to the change in viscosity.

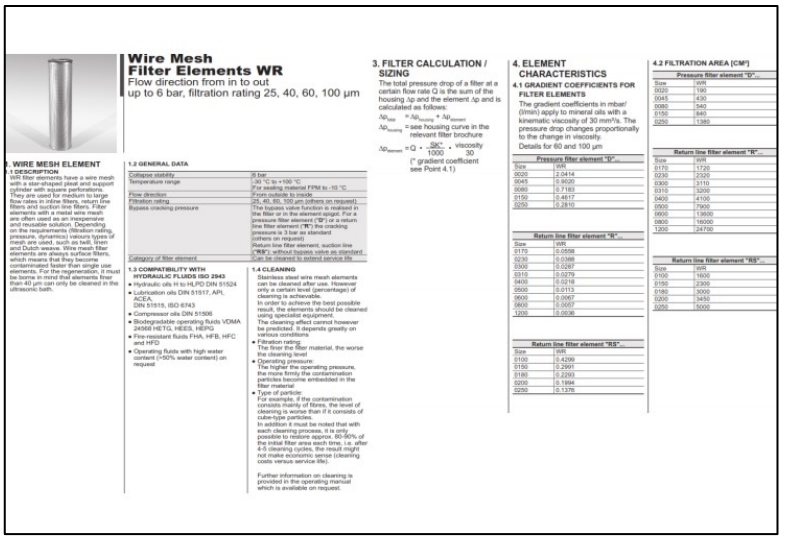
Size	3 µm	10 µm
330	8.7	3.6
500	5.7	2.0
660	3.5	1.2
750	2.3	0.8
850	2.8	0.9
950	2.4	0.8
1300	1.6	0.6
1700	1.3	0.5
2600	0.8	0.3
2700	1.0	0.3

5.2 CONTAMINATION RETENTION CAPACITY IN G

The contamination retention and particle filtration performance of an element are established in the multipass test to ISO 16889. This procedure with its precisely-defined test conditions and a standard test dust (ISO MTD) enables the performance data of different elements to be compared.

Size	3 µm	10 µm
330	58.0	93.0
500	83.0	93.9
660	120.0	140.0
750	209.3	234.5
850	156.5	175.3
950	170.0	190.0
1300	240.0	270.0
1700	330.4	369.4
2600	490.0	540.0
2700	430.7	482.5

For information on bypass valve curves, please see Filter Element (Quick Selection) brochure no.: E 7.221./...



Wire Mesh Filter Elements WR

Flow direction from in to out

up to 6 bar, filtration rating 25, 40, 60, 100 µm

WIRE MESH ELEMENT

1 DESCRIPTION

WR filter elements have a wire mesh with a stainless steel pleat and support element as the basic structure. They are used for medium to large flow rates in inline filters, return line filters and suction line filters. Filter elements with a metal wire mesh are often used as an inexpensive alternative to paper. The differences on the requirements (filtration rating, pressure, dynamics) various types of mesh are used, such as twill, linen and Dutch weave. Wire mesh filter elements are used in inline filters, which means that they become contaminated faster than single use elements. For the regeneration, it must be borne in mind that elements finer than 40 µm can only be cleaned in the ultrasonic bath.

1.2 GENERAL DATA

Collapse stability	6 bar
Temperature range	-30 °C to +100 °C For sealing material FPM to -10 °C
Flow direction	From outside to inside
Filtration rating	25, 40, 60, 100 µm (others on request)
Bypass cracking pressure	The bypass valve function is realised in the filter or in the element spigot. For a pressure filter element ("D") or a return line filter element ("R") the cracking pressure is 3 bar as standard (others on request) Return line filter element, suction line ("RS"): without bypass valve as standard
Category of filter element	Can be cleaned to extend service life

1.3 COMPATIBILITY WITH HYDRAULIC FLUIDS ISO 2943

- Hydraulic oils H to HLPD DIN 51524
- Lubrication oils DIN 51517, API, ACEA, DIN 51515, ISO 6743
- Compressor oils DIN 51506
- Biodegradable operating fluids VDMA 24568 HETG, HEES, HEPG
- Fire-resistant fluids FHA, HFB, HFC and HFD
- Operating fluids with high water content (>50% water content) on request

1.4 CLEANING

Stainless steel wire mesh elements can be cleaned after use. However only a certain level (percentage) of cleaning is achievable.

In order to achieve the best possible results, the elements should be cleaned using specialist equipment.

The cleaning effect cannot however be predicted. It depends greatly on various conditions:

- Filtration rating:
  The finer the filter material, the worse the cleaning level
- Operating pressure:
  The higher the operating pressure, the more firmly the contamination particles become embedded in the filter mesh
- Type of particle:
  For example, if the contamination consists mainly of fibres, the level of cleaning is worse than if it consists of cube-type particles.

In addition it must be noted that with each cleaning process, it is only possible to restore approx. 80-90% of the initial filter area each time, i.e. after 4-5 cleaning cycles, the result might not make economic sense (cleaning costs versus service life).

Further information on cleaning is provided in the operating manual which is available on request.

3. FILTER CALCULATION / SIZING

The total pressure drop of a filter at a certain flow rate Q is the sum of the housing Δp and the element Δp and is calculated as follows:

$\Delta p_{total} = \Delta p_{housing} + \Delta p_{element}$

$\Delta p_{housing}$ = see housing curve in the relevant filter brochure

$\Delta p_{element} = Q \cdot \frac{SK}{1000} \cdot \frac{viscosity}{30}$

(* gradient coefficient see Point 4.1)

4. ELEMENT CHARACTERISTICS

4.1 GRADIENT COEFFICIENTS FOR FILTER ELEMENTS

The gradient coefficients in mbar/(l/min) apply to mineral oils with a kinematic viscosity of 30 mm²/s. The pressure drop changes proportionally to the change in viscosity.

Details for 60 and 100 µm

Pressure filter element "D"...

Size	WR
0020	2.2414
0045	0.9630
0080	0.7160
0150	0.4617
0250	0.2810

Return line filter element "R"...

Size	WR
0170	0.0558
0230	0.0388
0300	0.0287
0310	0.0279
0400	0.0218
0500	0.0113
0600	0.0067
0800	0.0057
1200	0.0036

Return line filter element "RS"...

Size	WR
0100	0.4299
0150	0.2997
0180	0.2293
0200	0.1994
0250	0.1376

4.2 FILTRATION AREA (CM²)

Pressure filter element "D"...

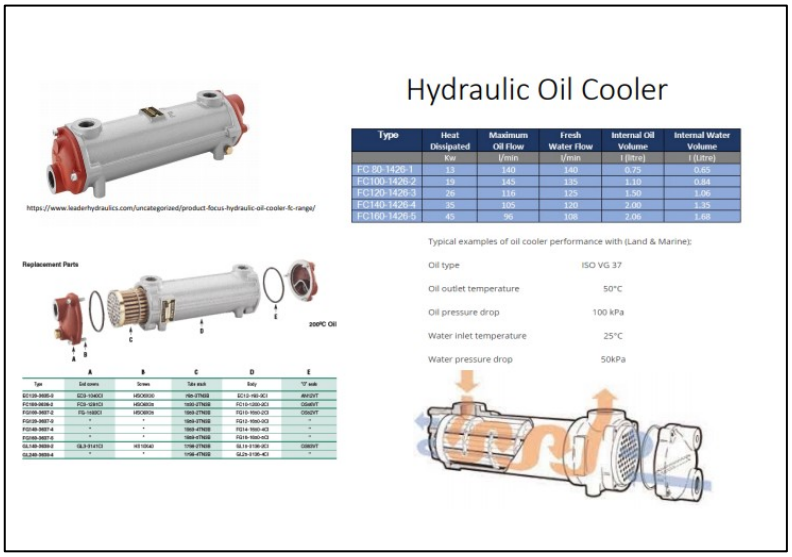
Size	WR
0020	190
0045	430
0080	540
0150	840
0250	1380

Return line filter element "R"...

Size	WR
0170	1720
0230	2320
0300	3110
0310	3200
0400	4100
0500	7900
0600	13000
0800	16000
1200	24700

Return line filter element "RS"...

Size	WR
0100	1600
0150	2300
0180	3000
0200	3450
0250	5000



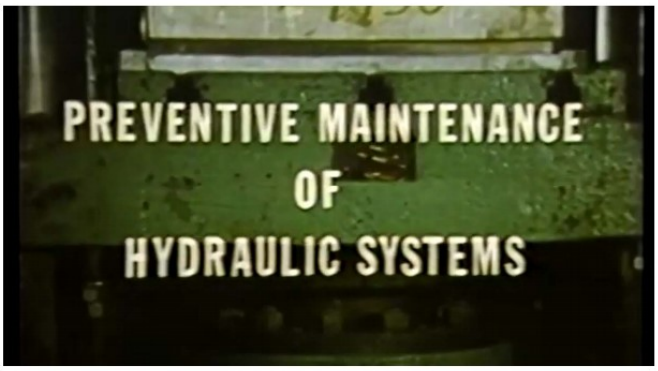
Type	Heat Dissipated	Maximum Oil Flow	Fresh Water Flow	Internal Oil Volume	Internal Water Volume
	Kw	l/min	l/min	l (litre)	l (Litre)
FC 80-1426-1	13	140	140	0.75	0.65
FC100-1426-2	19	145	135	1.10	0.84
FC120-1426-3	26	116	125	1.50	1.06
FC140-1426-4	35	105	120	2.00	1.35
FC160-1426-5	45	96	108	2.06	1.68

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

By M. Khunthawat

Online Regional Training Course Of Deck Machinery And Hauling Devices To Reduce Manpower In Fishing Vessels And Enhance Safety In Fishing Operations, May 5-6, 2021

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES



SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Safety precautions

- Always read the Safety Data Sheet for the hydraulic oil used in your system.
- Minimize skin contact with hydraulic oil.
- Do not use gasoline, solvents, kerosene or similar products to remove oil from the skin. Use soap and water.
- Do not wear oilsoaked clothing.
- Wash hands and face before eating.
- Clean up spilled oil promptly and dispose of it correctly.
- Avoid inhalation of oil mist vapours.
- Obtain medical advice on all potential health hazard problems.

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Hydraulic systems store fluid under high pressure typically, at 2,000 or more pounds per square inch (psi)

Hazards:

- Stored energy
  - Failing hydraulic hose during use
  - Maintenance conducted without releasing pressure
  - Maintenance conducted after incorrectly releasing the pressure
- High temperature fluid (150 F/65 °C or higher 110 °C)
- Ignition of fluid (Flammability)
- Injection of fluid into the body

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

The operator was burned when a hydraulic hose neglected during maintenance, burst and spewed hydraulic oil, at normal operating temperature over his entire body.

Never use hands and fingers to find leaks.

Fluid under high pressure can be injected into the skin causing extreme injury, serious infection.

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Fire and explosion risk of hydraulic fluid

- High flash point: 300 – 600 F (149 – 316 C)
- Under pressure, atomized spray of droplets may travel a considerable distance from the break
- Ignites readily by heat source
- Resulting fire is torch-like with very high heat release rate
- Mist in confined area can explode violently

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Inspect defective hydraulic hose daily

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Always relieve hydraulic pressure before performing maintenance

Hydraulic hose whip

Hydraulic high pressure line whip cut

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Working with hydraulic oils

- Avoid prolong breathing of its vapor, mist, and fumes
- Avoid prolong or repeated skin contact
- Use chemical-resistance gloves, splash goggles and a chemical-resistant apron
- Wash off affected skin, eyes, and protective clothing immediately. Remove contaminated clothing, and launder before reuse
- After contact with hydraulic oil always cleanse skin with a waterless hand cleanser, and then wash with soap and water
- Never begin work on a hydraulic system until fully trained

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Working with hydraulic oils

- Use all required personal protective equipment
  - Safety goggles "and" face shield
  - Protective apron
  - Protective gloves
  - Hard hat
  - Steel toes leather shoes
- Always relieve pressure before performing any maintenance on a hydraulic system
- Use extreme caution when disconnecting hydraulic lines
- Clean up spills immediately. Hydraulic fluid can cause slips, falls and resulting injuries

SAFETY PRECAUTIONS AND GOOD WATCHKEEPING PRACTICES

Working with hydraulic oils

- Do not work under equipment / apparatus being supported by hydraulics
  - Stops, safety pin, etc., must be in place before repairs begin

PERIODICAL CHECK AND MAINTENANCE OF HYDRAULIC SYSTEM

Maintenance tasks: Daily

- Check oil levels in power unit tanks.
- Check for temperature changes in the oil.
- Check the system for water or dirt in the oil.
- Check for leaks.
- Check and tighten screws and pipe clamps.
- Verify pressure gauge readings.
- Monitor the running noise of pumps and electric motors to identify changes.
- Empty all valve panel drip pans.
- Check for possible leaks in valve groups by wiping an item clean before inspecting it.
- Keep surfaces of pipes, components and tanks clean.
- Check with operators to determine if any service or maintenance is required.
- Check the service book to see if operators have recorded any problems.

PERIODICAL CHECK AND MAINTENANCE OF HYDRAULIC SYSTEM

Maintenance tasks: Every six weeks

- Check air filters.
- For filters with a contamination indicator, replace the filter element when the indicator shows a dirty filter.
- Check and clean the strainer in the cooling water pipe.
- Clean the hydraulic power unit and check for possible leaks.
- Check for possible leaks in the piping connections.
- While the pumps are stopped, tighten any loosened connections. Tighten only to stop the leak and no tighter.
- Replace any fittings or pipes which continue leaking after being tightened. Replace any leaking seals.
- Check the condition of hydraulic hoses. Remove major dirt buildups. If the hoses have cracks or if oil seeps between the sleeve and hose (hose end is moist), replace the hose.
- Check the condition of all hydraulic cylinders. Remove any dirt, especially from piston rod pivots.
- Tighten pipe clamps, if necessary.
- Tighten bolts on the pumps, electric motors, valves, etc.
- Record all maintenance in the service book.

PERIODICAL CHECK AND MAINTENANCE OF HYDRAULIC SYSTEM

Maintenance tasks: Annual

- Drain the power unit oil tank and clean the tank. Carefully remove any dirt accumulated on the bottom of the tank (inside). Thoroughly clean the insides of the tank using a cleaning solution approved by the oil supplier. Do not use cotton waste or cloths when cleaning the tank. If there is a time delay between cleaning and refilling the tank, keep it sealed to prevent moisture from getting inside the tank. Flush the piping.
- If the oil is to be re-used, make sure to drain it into clean containers.
- When re-filling the tank, make sure to filter the new or re-used oil using a separate filter unit.
- Check the pump and motor couplings.
- If the proportional valves require service, notify the component manufacturer or a service engineer authorized by that manufacturer to perform maintenance.
- Check the condition of the hydraulic system by testing all hydraulically actuated components.

HAULING DEVICE FOR SMALL FISHING BOAT (COASTAL FISHERY)

By M. Khunthawat

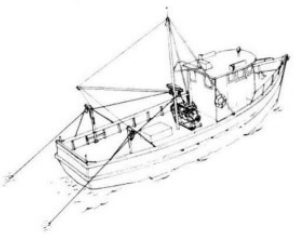
Online Regional Training Course Of Deck Machinery And Hauling Devices To Reduce Manpower In Fishing Vessels And Enhance Safety In Fishing Operations, May 5-6, 2021

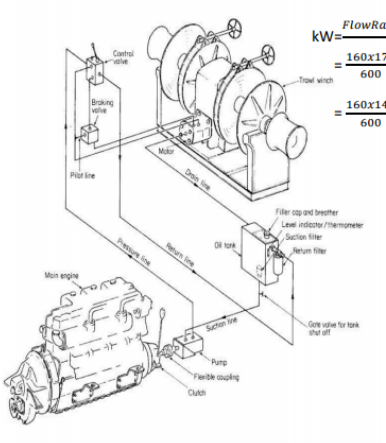
Several practices during hauling fishing gear




Combined net and line hauler powered by engine or hydraulic system


Small stern trawler of North Sea

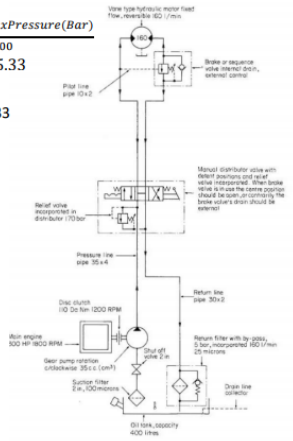




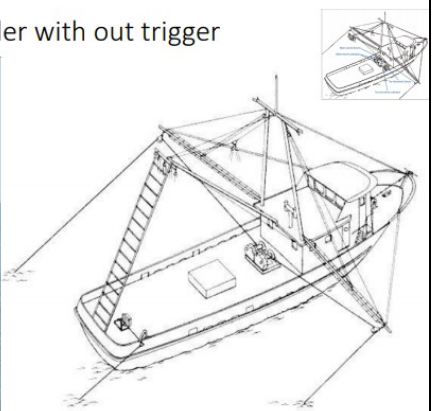
$$kW=\frac{FlowRate\left(\frac{L}{min}\right)xPressure(Bar)}{600}$$

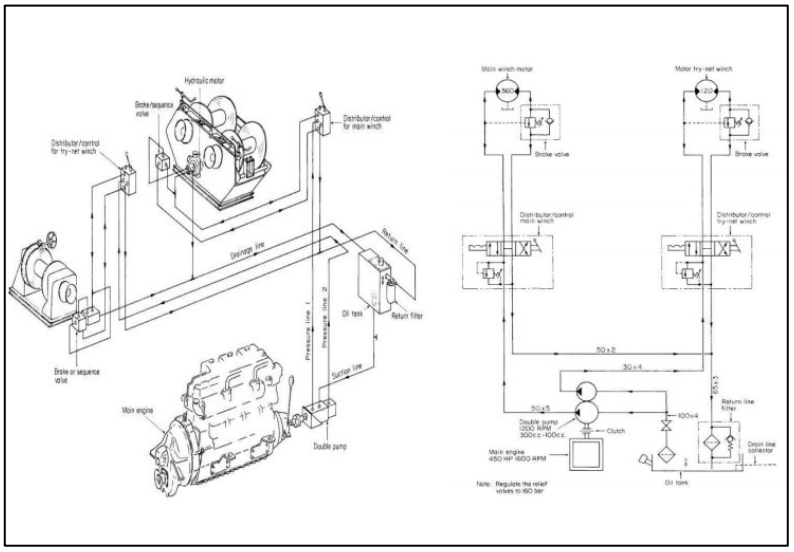
$$=\frac{160x170}{600}=45.33$$

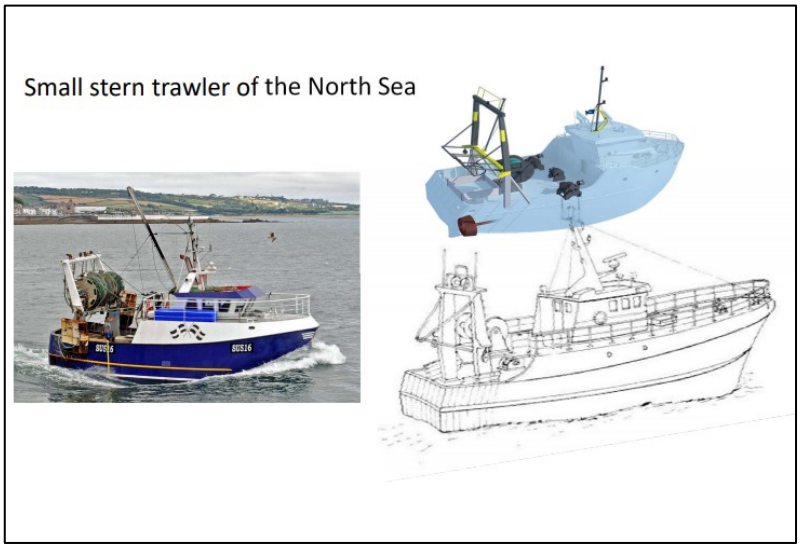
$$=\frac{160x140}{600}=37.33$$

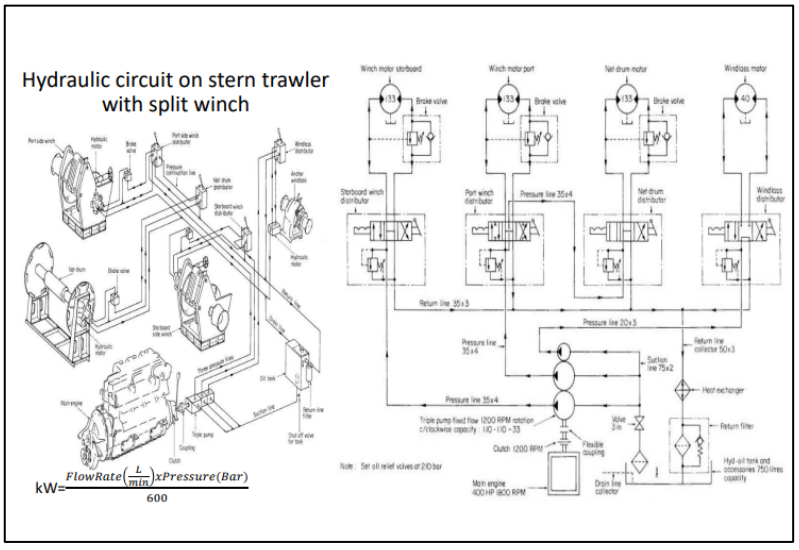


Shrimp trawler with out trigger

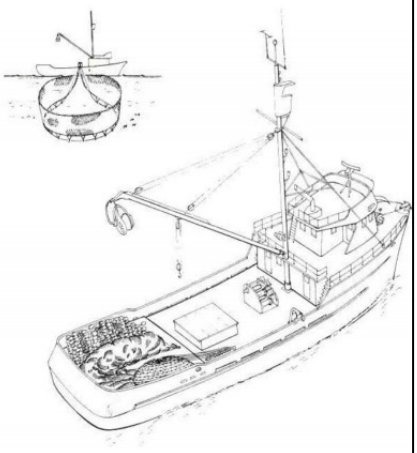



Hydraulic motor
Brake/sequence valve
Distributor/control for main winch
Distributor/control for try-net winch
Overflow line
Return line
Oil tank
Return filter
Pressure line 1
Pressure line 2
Suction line
Brake or sequence valve
Main engine
Double pump
Main winch motor
Motor try-net winch
Brake valve
Distributor/control main winch
Distributor/control try-net winch
50 x 2
30 x 4
65 x 3
50 x 5
100 x 4
Double pump 1200 RPM 300cc-100cc
Clutch
Return line filter
Drain line collector
Main engine 450 HP 1800 RPM
Oil tank
Note: Regulate the relief valves to 180 bar

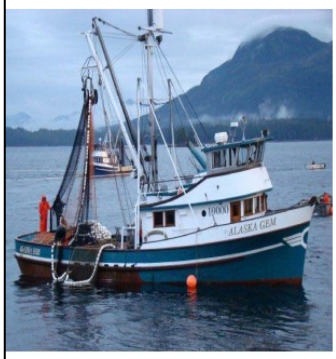

Small stern trawler of the North Sea

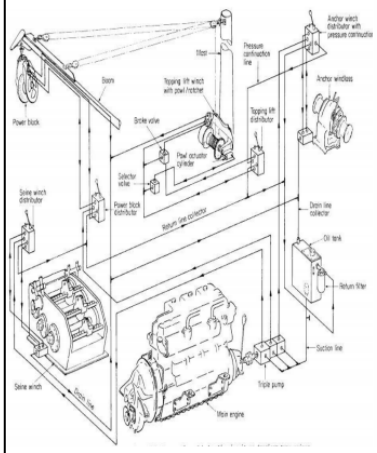

Hydraulic circuit on stern trawler with split winch
Winch motor starboard
Winch motor port
Net drum motor
Windlass motor
Brake valve
Starboard winch distributor
Port winch distributor
Pressure line 35x4
Net drum distributor
Windlass distributor
Return line 35x3
Pressure line 20x3
Pressure line 35x4
Return line collector 50x3
Suction line 75x2
Heat exchanger
Pressure line 35x4
Triple pump fixed flow 1200 RPM rotation c/clockwise capacity : 110 -110 - 33
Valve 3-in
Return filter
Clutch 1200 RPM
Flexible coupling
Hyd-oil tank and accessories 750 litres capacity
Note : Set all relief valves at 210 bar
Main engine 400 HP 1800 RPM
Drain line collector
kW=$\frac{FlowRate\left(\frac{L}{min}\right)xPressure(Bar)}{600}$

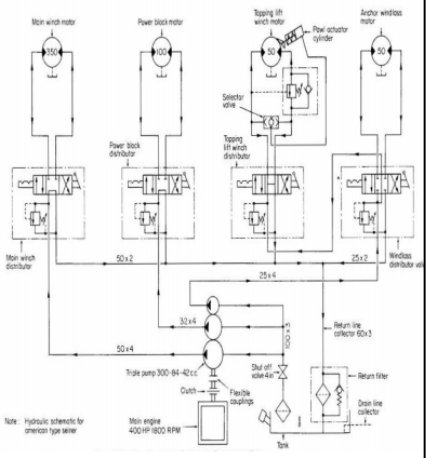
Small scale purse seine



Small scale purse seine in Alaska

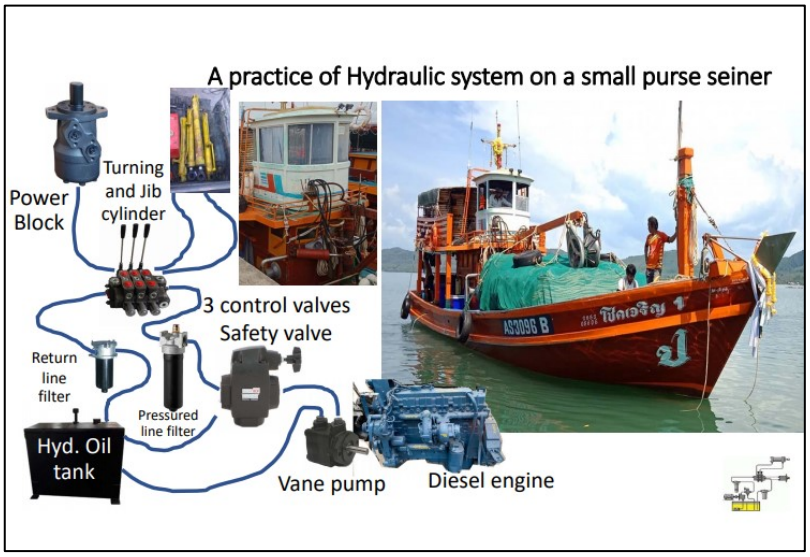


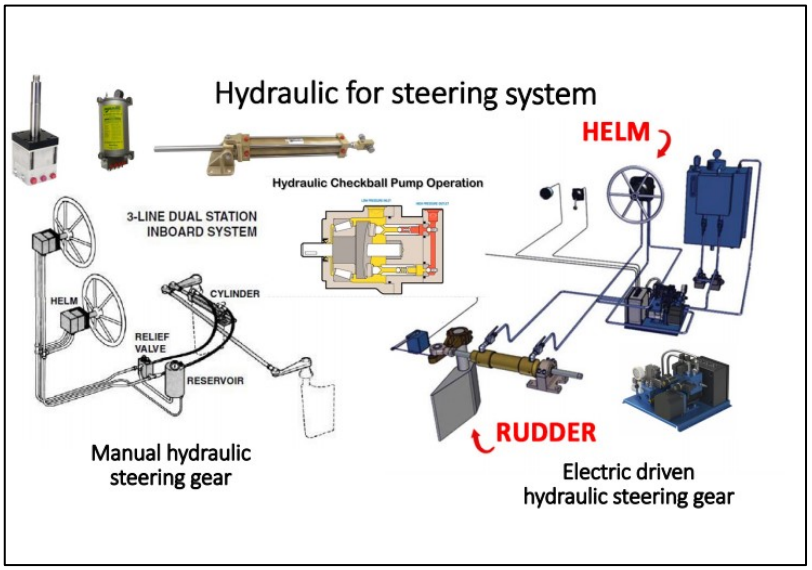


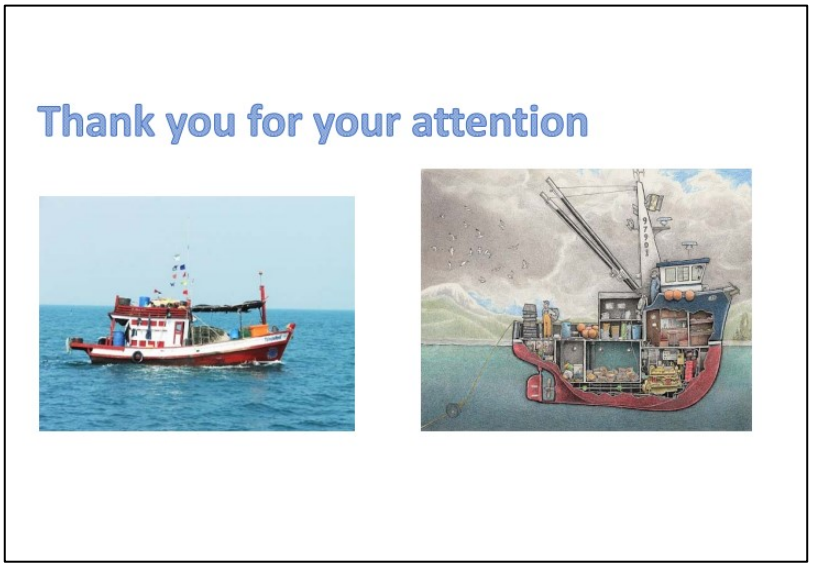



Man powered purse seine fishing boat

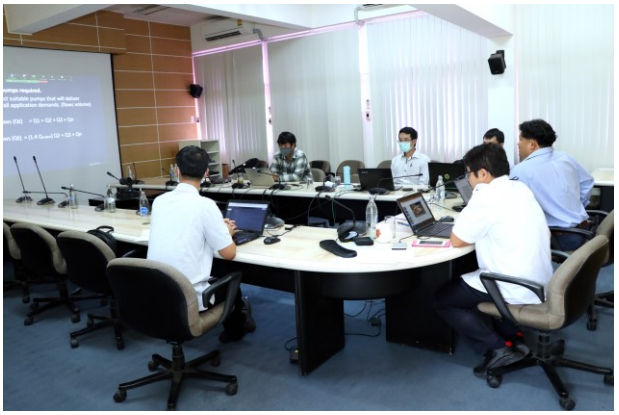

Hydraulic system on small purse seiner

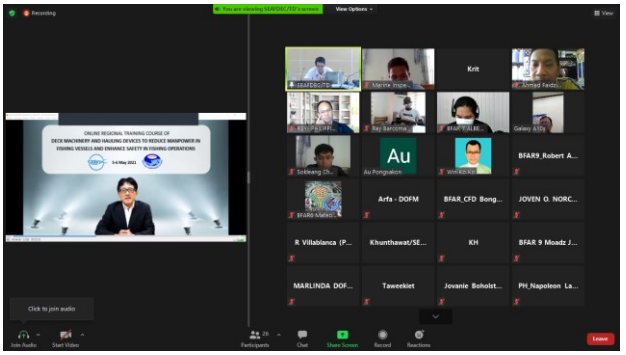

A practice of Hydraulic system on a small purse seiner
Power Block
Turning and Jib cylinder
3 control valves
Safety valve
Return line filter
Pressured line filter
Hyd. Oil tank
Vane pump
Diesel engine

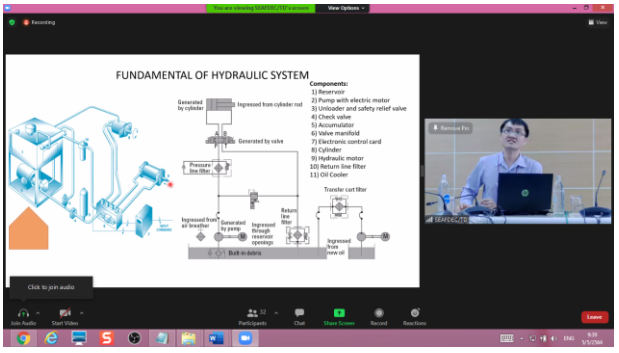

Hydraulic for steering system
HELM
Hydraulic Checkball Pump Operation
3-LINE DUAL STATION
INBOARD SYSTEM
CYLINDER
HELM
RELIEF
VALVE
RESERVOIR
RUDDER
Manual hydraulic
steering gear
Electric driven
hydraulic steering gear


Thank you for your attention

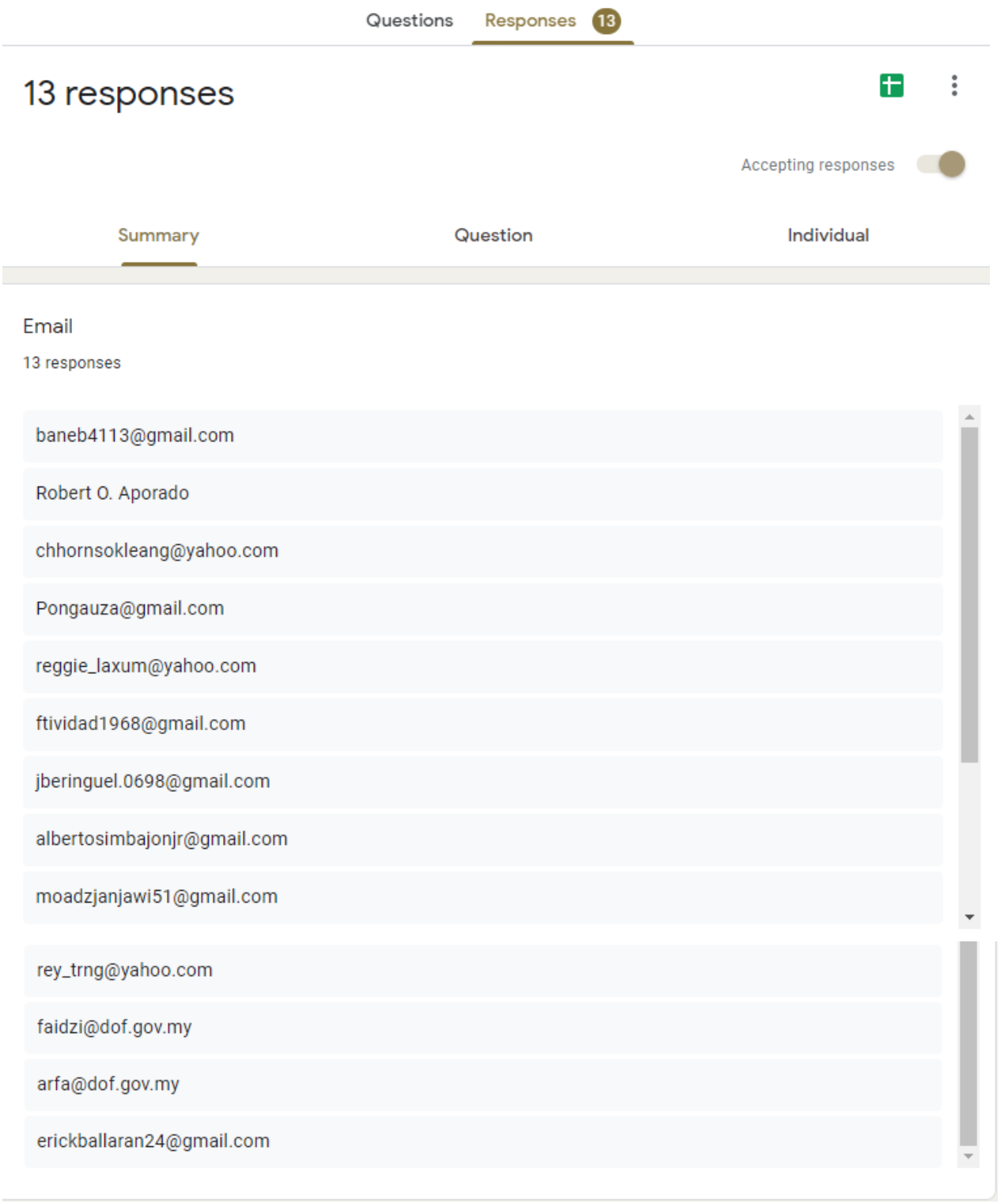
Appendix 6. Photo of activities





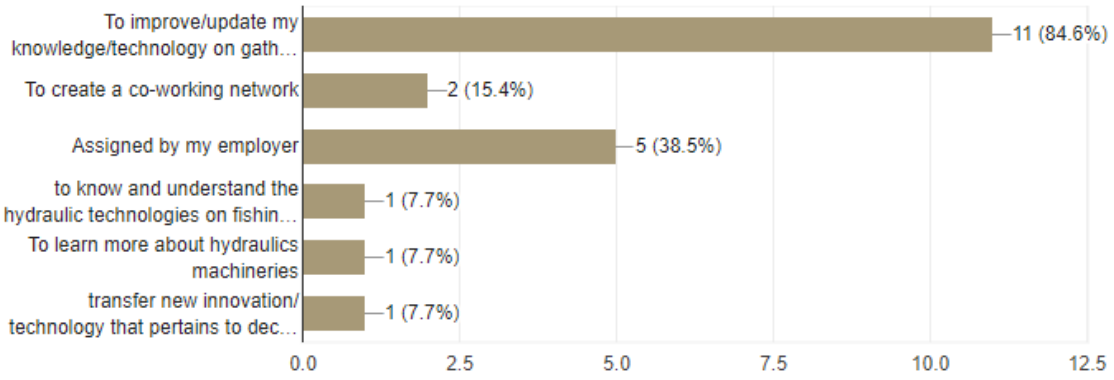


Appendix 7. Google form evaluation



1. What was your main motivation or reason to attend this Online Regional Training Course of Deck Machineries and Hauling Devices to Reduce Manpower in Fishing Vessels and Enhance Safety in Fishing Operations? (Check one or more answers on the squares provided)

13 responses



2. Please indicate the most important knowledge/technologies that you expected to improve/obtain in attending this online training program.

13 responses

I want to learn about hydraulics especially on fishing vessels.

Operation ang maintenance of hydraulic and power blocks

I can improve the knowledge on Hydraulic system and safety in fishing operations.

Fishing gears& hydraulic system

all of the abovementioned technologies

Hydraulics and what can this do to improve fishing activities

Mechanization of Fishing Vessels

I learn very well on the application of hydraulic system in the conduct of fishing operation.

regarding the hydraulic system.

The operation and maintenance of deck machineries & hauling device especially on purse seine.

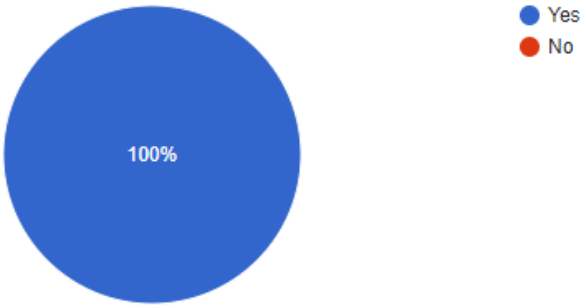
New technology to reduce manpower

the suggestion to reduce man power on fishing vessel

To know the different deck machineries

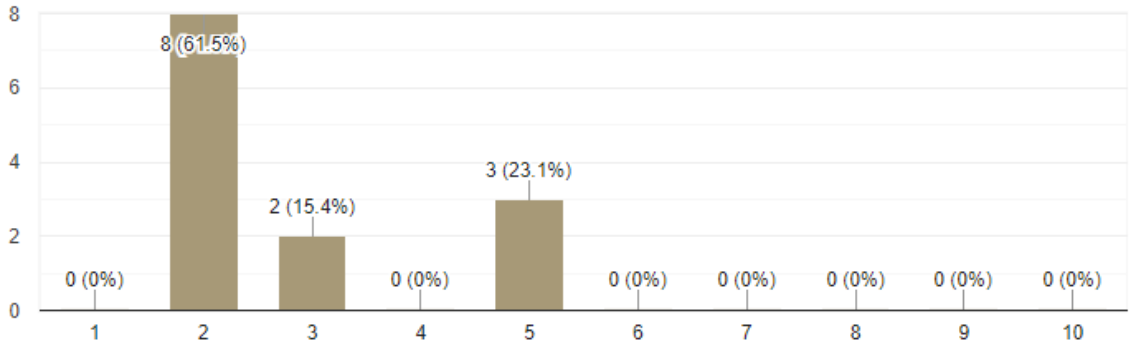
3. Were your expectations in question (2), regarding the areas of knowledge and skills you expected to obtain, fulfilled?

13 responses



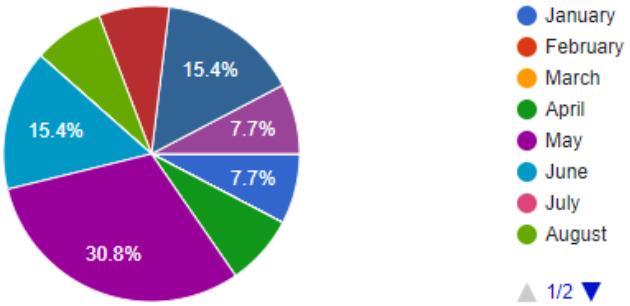
4. The appropriate total duration of the online training should be ..... days

13 responses



5. The appropriate period of the online training for you/your office should be:

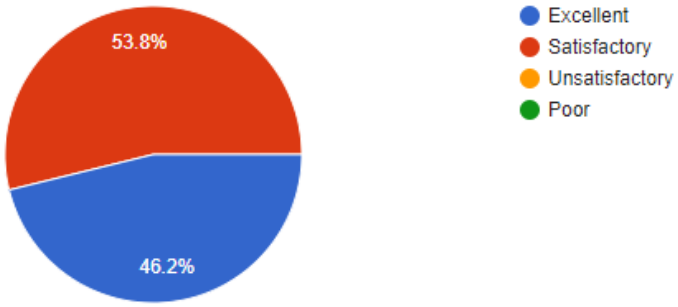
13 responses



6. Please comment on the following subjects based on your needs/expectations.

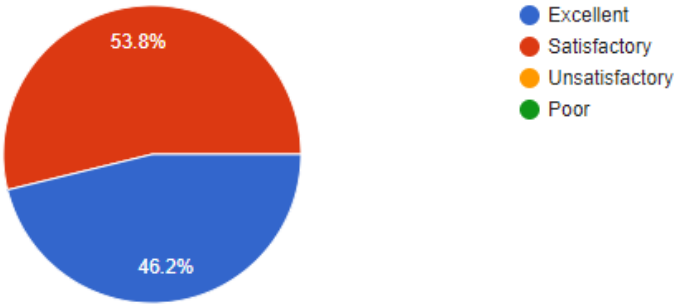
Introduction to concepts of oil hydraulics components. (Mr.Suthipong)

13 responses



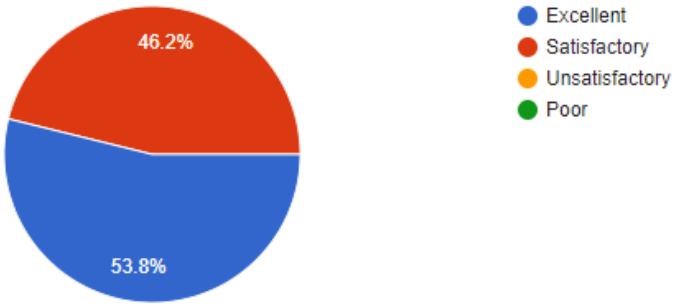
The Importance of Hydraulic system related to the fishing vessel. (Mr.Khunthawat)

13 responses



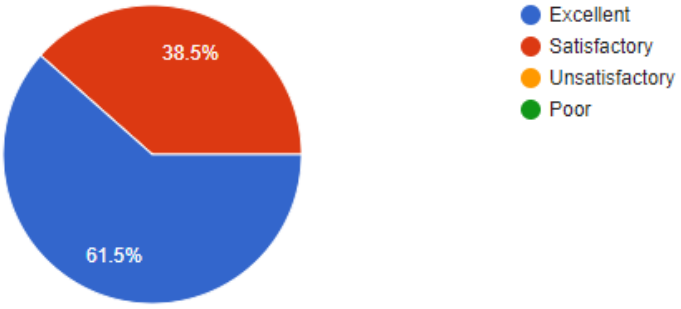
Safety precautions and good watchkeeping practices. (Mr.Khunthawat)

13 responses



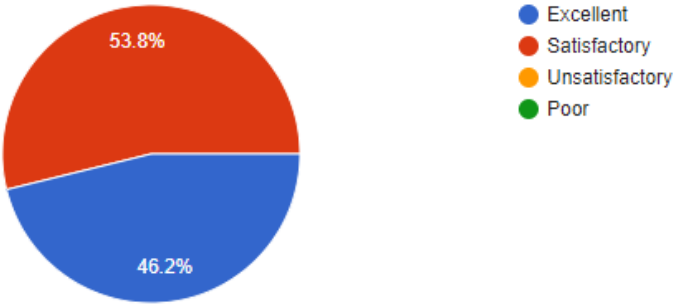
Hauling device for fishing vessel. (Mr.Thaweesak)

13 responses



Online demonstration (Marine Engineering Section)

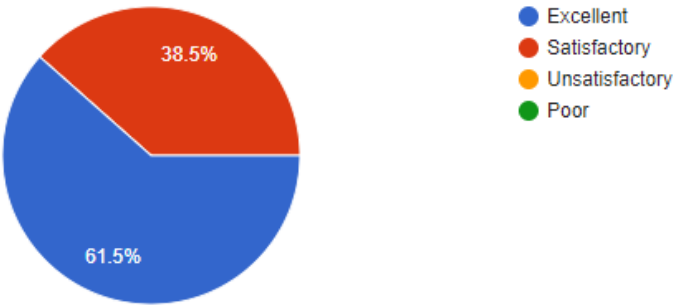
13 responses



7. Please comment on the following subjects based on your needs/expectations.

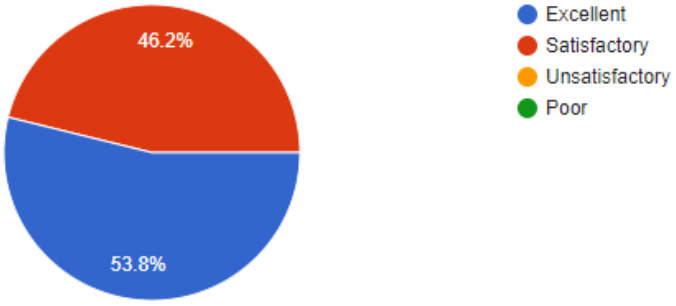
Introduction to concepts of oil hydraulics, Components. (Mr.Suthipong)

13 responses



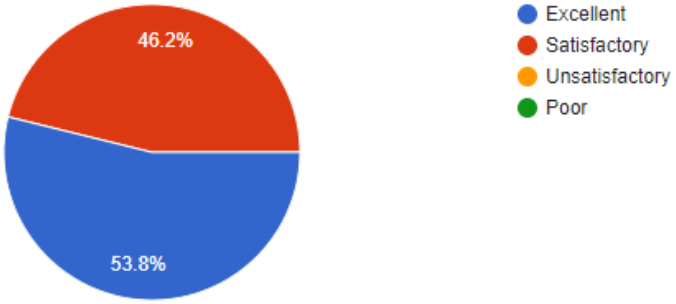
The Importance of Hydraulic system related to the fishing vessel. (Mr.Khunthawat)

13 responses



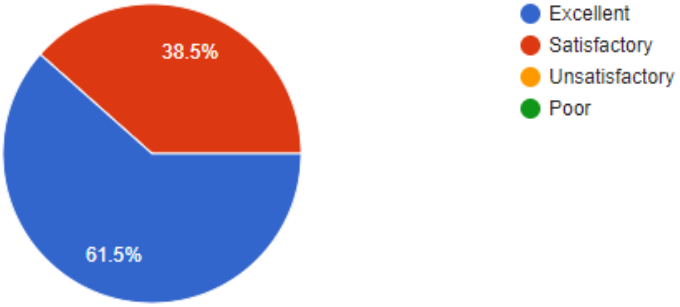
Safety precautions and good watchkeeping practices. (Mr.Khunthawat)

13 responses



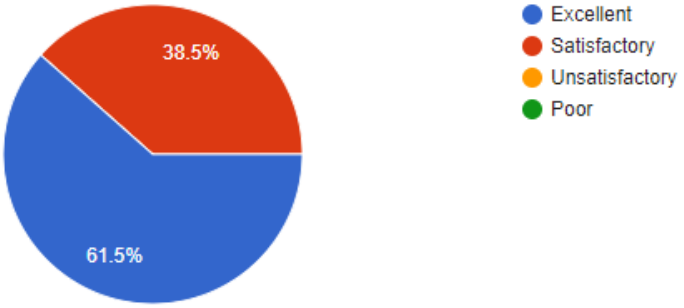
Hauling device for fishing vessel. (Mr.Thaweesak)

13 responses



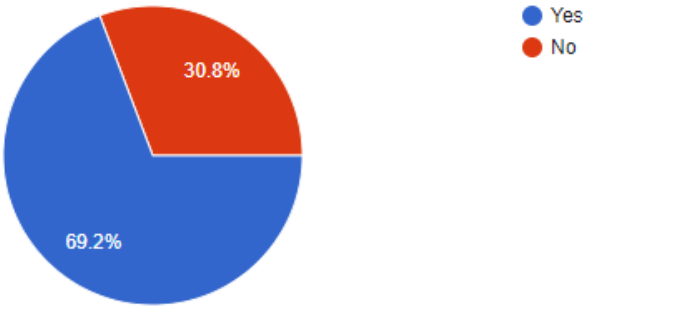
Online demonstration (Marine Engineering Section)

13 responses



8. In overall, The Zoom platform is a suitable meeting platform for this online training?

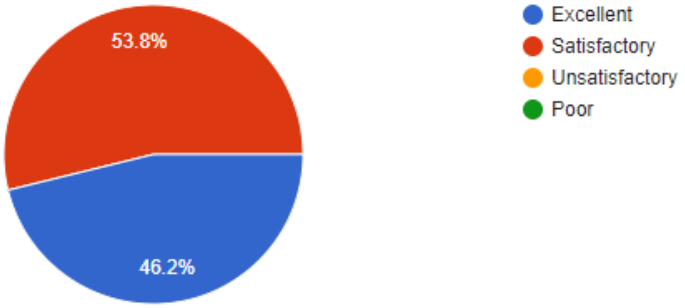
13 responses



9. Technical Performance of Online training

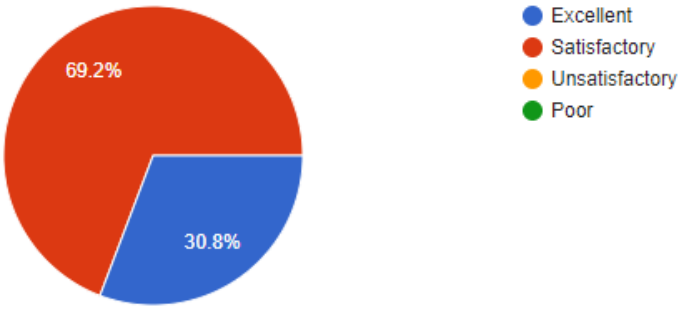
9.1 Displaying Quality of online presentations

13 responses



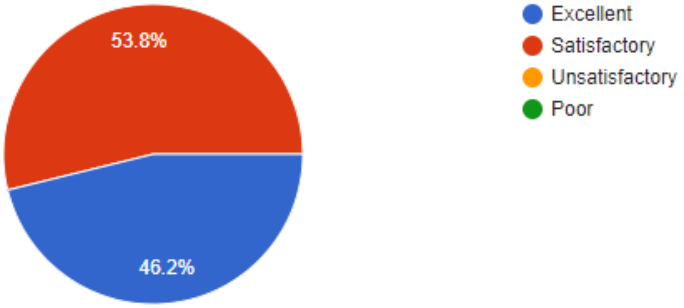
9.2 Sound quality of online presentations

13 responses



9.3 SEAFDEC/TD internet speed

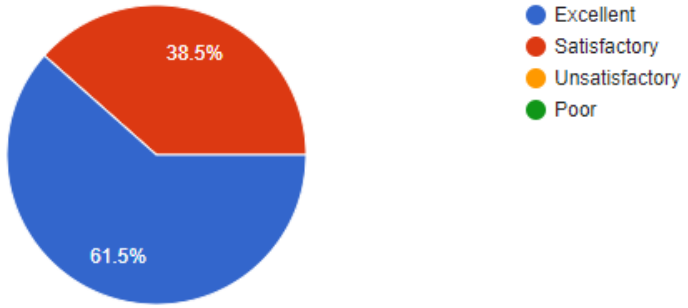
13 responses



Please tell us how much you agree or disagree with the following statements?

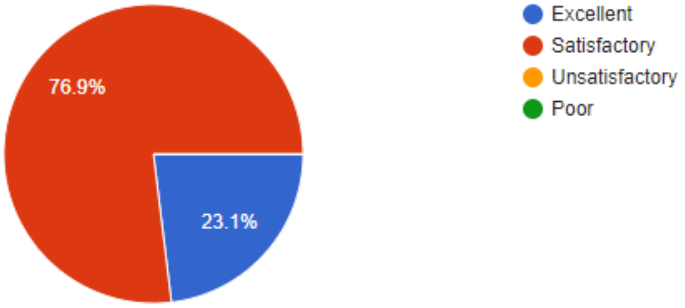
10. The trainers were knowledgeable

13 responses



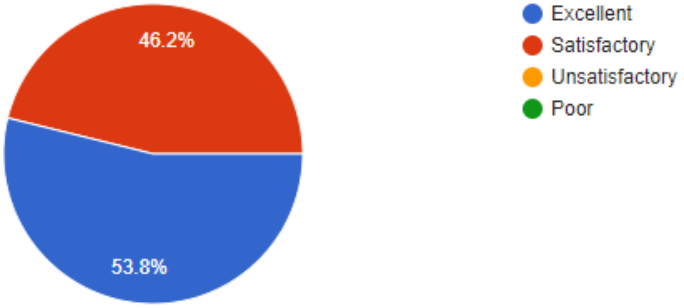
11. The trainers communicated clearly and effectively

13 responses



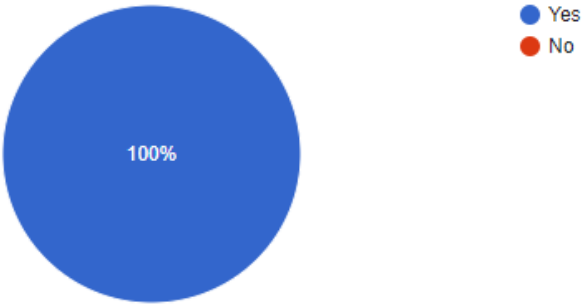
12. The Online training was well-organized

13 responses



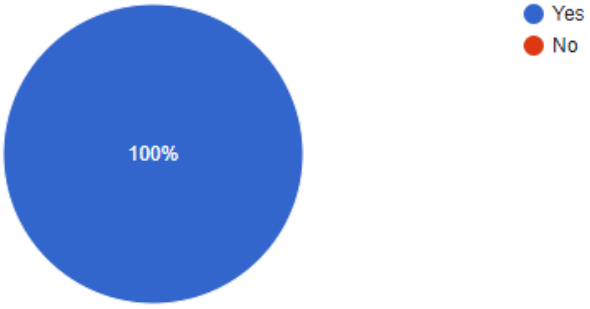
13. Has your skill/knowledge increased as a result of the online training?

13 responses



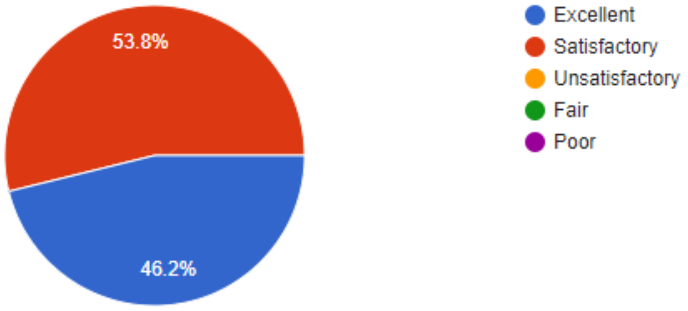
14. Will you be able to apply what you learned to your job?

13 responses



15. How would you rate this online training overall?

13 responses



16. Please tell us what did you like best about this online training?

13 responses

I like the fact that the resource speaker is very knowledgable about the hydraulics and every topic they are assigned to discuss.

Fish pump, and hydraulic schematics diagram.

Sharing about knowledge and experience on Hydraulic system and hauling device onboard to reduce manpower and labor-saving.

New experience for me

all of the abovementioned technologies

The trainors were able to present their expertise on all topics very clearly even though that the online training is much far difficult compared to face to face training course

Introduction of modified hauling devices.

all of it .

The sharing of technology by SEAFDEC to member countries.

additional learnings/knowledge about deck machineries and hauling devices.

Video presentation

hauling devices for fishing vessel

Hydraulics

17. Suggestion for improvements the Online training programs in future?

13 responses

I guess. It would be nice if we saw actual practice or model of the hydraulics system.

This kind of training is best to conduct face to face in order the participants can hands on the said tools, equipments

I think that it very importance for apply to fisherman, But we haven't much knowledge about this technologies. In the future! If SEADEC have project please help to support the training and technologies to fisherman in Cambodai.

Face to face better than online

none since the overall performance of the online training is excellent.

I am very satisfied with the outcome of the online training course however face to face activities is better for us trainees for us to have hands-on or actual experience with the macheniries presented

none

it is better if face to face.

Face to Face training..

follow-up trainings related on the operation of deck machineries & hauling devices.

More video presentation on site

send the notes to participants before the training

Face to face Training-Workshop

End of Report