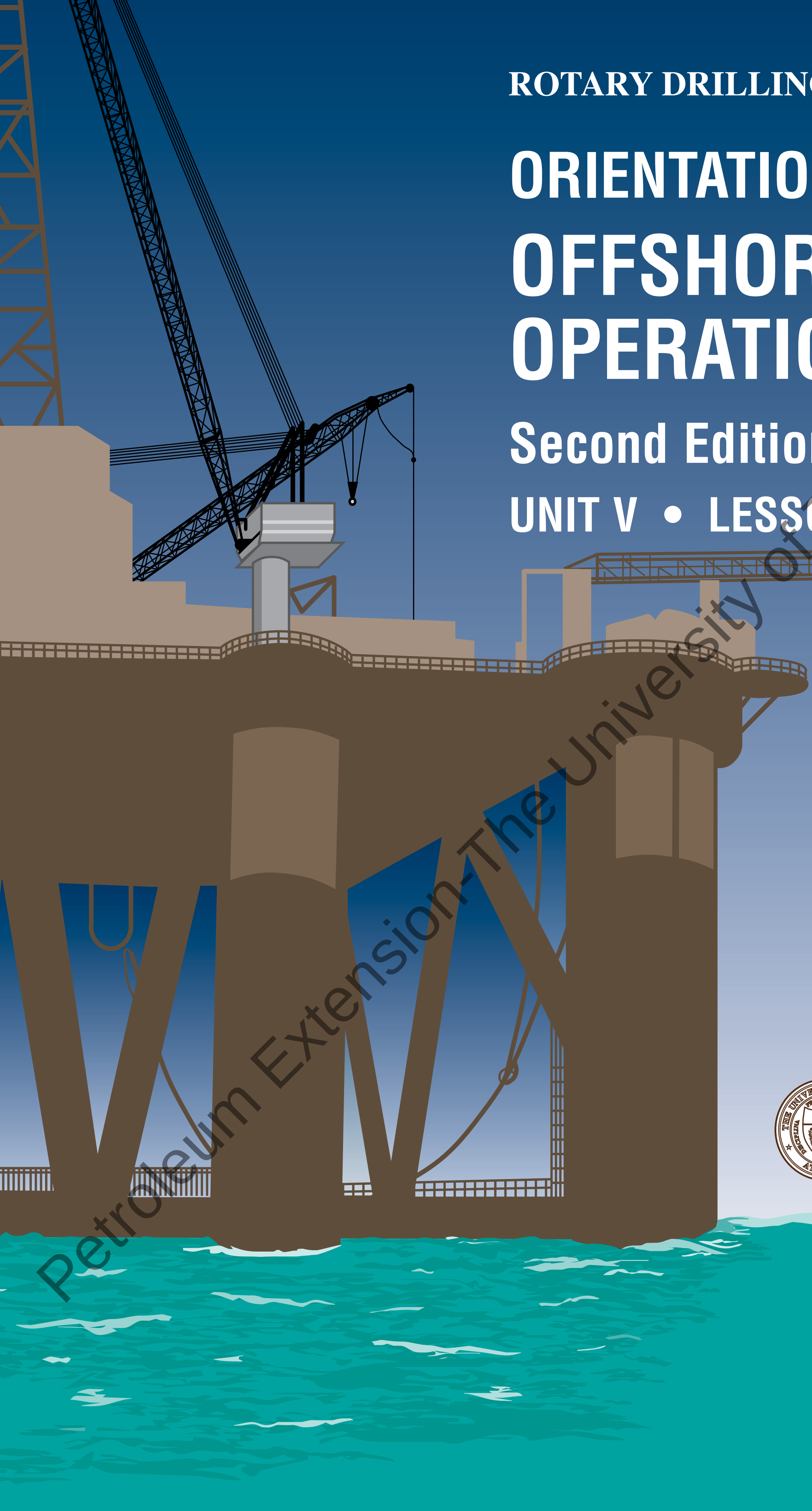
ROTARY DRILLING

ORIENTATION FOR OFFSHORE CRANE OPERATIONS

Second Edition

UNIT V • LESSON 8



ROTARY DRILLING SERIES

Unit I: The Rig and Its Maintenance

Lesson 1: The Rotary Rig and Its Components
Lesson 2: The Bit
Lesson 3: Drill String and Drill Collars
Lesson 4: Rotary, Kelly, Swivel, Tongs, and Top Drive
Lesson 5: The Blocks and Drilling Line
Lesson 6: The Drawworks and the Compound
Lesson 7: Drilling Fluids, Mud Pumps, and Conditioning Equipment
Lesson 8: Diesel Engines and Electric Power
Lesson 9: The Auxiliaries
Lesson 10: Safety on the Rig

Unit II: Normal Drilling Operations

Lesson 1: Making Hole
Lesson 2: Drilling Fluids
Lesson 3: Drilling a Straight Hole
Lesson 4: Casing and Cementing
Lesson 5: Testing and Completing

Unit III: Nonroutine Operations

Lesson 1: Controlled Directional Drilling
Lesson 2: Open-Hole Fishing
Lesson 3: Blowout Prevention

Unit IV: Man Management and Rig Management

Unit V: Offshore Technology

Lesson 1: Wind, Waves, and Weather
Lesson 2: Spread Mooring Systems
Lesson 3: Buoyancy, Stability, and Trim
Lesson 4: Jacking Systems and Rig Moving Procedures
Lesson 5: Diving and Equipment
Lesson 6: Vessel Inspection and Maintenance
Lesson 7: Helicopter Safety
Lesson 8: Orientation for Offshore Crane Operations
Lesson 9: Life Offshore
Lesson 10: Marine Riser Systems and Subsea Blowout Preventers

Contents

Units of Measurement

Throughout the world, two systems of measurement dominate: the English system and the metric system. Today, the United States is almost the only country that employs the English system.

The English system uses the pound as the unit of weight, the foot as the unit of length, and the gallon as the unit of capacity. In the English system, for example, 1 foot equals 12 inches, 1 yard equals 36 inches, and 1 mile equals 5,280 feet or 1,760 yards.

The metric system uses the gram as the unit of weight, the metre as the unit of length, and the litre as the unit of capacity. In the metric system, for example, 1 metre equals 10 decimetres, 100 centimetres, or 1,000 millimetres. A kilometre equals 1,000 metres. The metric system, unlike the English system, uses a base of 10; thus, it is easy to convert from one unit to another. To convert from one unit to another in the English system, you must memorize or look up the values.

In the late 1970s, the Eleventh General Conference on Weights and Measures described and adopted the Système International (SI) d'Unités. Conference participants based the SI system on the metric system and designed it as an international standard of measurement.

The *Rotary Drilling Series* gives both English and SI units. And because the SI system employs the British spelling of many of the terms, the book follows those spelling rules as well. The unit of length, for example, is *metre*, not *meter*. (Note, however, that the unit of weight is *gram*, not *gramme*.)

To aid U.S. readers in making and understanding conversion to the SI system, we include the following table.

English-Units-to-SI-Units Conversion Factors

Quantity or Property	English Units	Multiply English Units By	To Obtain These SI Units
Length, depth, or height	inches (in.)	25.4	millimetres (mm)
		2.54	centimetres (cm)
	feet (ft)	0.3048	metres (m)
	yards (yd)	0.9144	metres (m)
	miles (mi)	1609.344	metres (m)
		1.61	kilometres (km)
Hole and pipe diameters, bit size	inches (in.)	25.4	millimetres (mm)
Drilling rate	feet per hour (ft/h)	0.3048	metres per hour (m/h)
Weight on bit	pounds (lb)	0.445	decanewtons (dN)
Nozzle size	32nds of an inch	0.8	millimetres (mm)
Volume	barrels (bbl)	0.159	cubic metres (m^3)
		159	litres (L)
	gallons per stroke (gal/stroke)	0.00379	cubic metres per stroke (m^3/stroke)
	ounces (oz)	29.57	millilitres (mL)
	cubic inches ($in.^3$)	16.387	cubic centimetres (cm^3)
	cubic feet (ft^3)	28.3169	litres (L)
		0.0283	cubic metres (m^3)
	quarts (qt)	0.9464	litres (L)
	gallons (gal)	3.7854	litres (L)
	gallons (gal)	0.00379	cubic metres (m^3)
	pounds per barrel (lb/bbl)	2.895	kilograms per cubic metre (kg/m^3)
	barrels per ton (bbl/tn)	0.175	cubic metres per tonne (m^3/t)
Pump output and flow rate	gallons per minute (gpm)	0.00379	cubic metres per minute (m^3/min)
	gallons per hour (gph)	0.00379	cubic metres per hour (m^3/h)
	barrels per stroke (bbl/stroke)	0.159	cubic metres per stroke (m^3/stroke)
	barrels per minute (bbl/min)	0.159	cubic metres per minute (m^3/min)
Pressure	pounds per square inch (psi)	6.895	kilopascals (kPa)
		0.006895	megapascals (MPa)
Temperature	degrees Fahrenheit (°F)	$\frac{°F - 32}{1.8}$	degrees Celsius (°C)
Thermal gradient	1°F per 60 feet	—	1°C per 33 metres
Mass (weight)	ounces (oz)	28.35	grams (g)
	pounds (lb)	453.59	grams (g)
		0.4536	kilograms (kg)
	tons (tn)	0.9072	tonnes (t)
	pounds per foot (lb/ft)	1.488	kilograms per metre (kg/m)
Mud weight	pounds per gallon (ppg)	119.82	kilograms per cubic metre (kg/m^3)
	pounds per cubic foot (lb/ft^3)	16.0	kilograms per cubic metre (kg/m^3)
Pressure gradient	pounds per square inch per foot (psi/ft)	22.621	kilopascals per metre (kPa/m)
Funnel viscosity	seconds per quart (s/qt)	1.057	seconds per litre (s/L)
Yield point	pounds per 100 square feet (lb/100 ft^2)	0.48	pascals (Pa)
Gel strength	pounds per 100 square feet (lb/100 ft^2)	0.48	pascals (Pa)
Filter cake thickness	32nds of an inch	0.8	millimetres (mm)
Power	horsepower (hp)	0.75	kilowatts (kW)
Area	square inches ($in.^2$)	6.45	square centimetres (cm^2)
	square feet (ft^2)	0.0929	square metres (m^2)
	square yards (yd^2)	0.8361	square metres (m^2)
	square miles (mi^2)	2.59	square kilometres (km^2)
	acre (ac)	0.40	hectare (ha)
Drilling line wear	ton-miles (tn•mi)	14.317	megajoules (MJ)
		1.459	tonne-kilometres (t•km)
Torque	foot-pounds (ft•lb)	1.3558	newton metres (N•m)

The Pedestal Crane

▼
▼
▼

Offshore cranes play a vital role in the exploration for new energy sources below the oceans. Most drilling offshore is taking place on the continental shelves, those portions of the continents which extend out to a depth of about 600 feet. The continental shelves underlie about 10% of the oceans around the globe, an area equivalent to a land mass the size of Africa. Their widths vary from 10 to 200 miles, depending on geographic location. Beyond the shelves is the continental slope that drops off to the abyssal plain—the ocean depths.

Millions of people around the world depend on the offshore crane and its operator for safe and efficient transfer of personnel, supplies, and materials necessary to find and produce oil from beneath the oceans.

Prime Movers and Transmissions

▼
▼
▼

A crane must have a source of power to operate. A prime mover or engine serves this purpose by converting chemical energy (fuel) into mechanical work through a drive shaft. In an internal combustion engine, fuel ignition in the cylinders drives pistons that are connected to a rotating shaft. Gas, gasoline, and diesel engines are internal combustion engines.

In common oilfield usage, the words engine and motor are used interchangeably to describe internal combustion engines. In reality, the term motor should be used only when referring to hydraulic, air, or electric motors or other apparatus that receives its primary power from or through another source.

With regards to cranes, the job of the prime mover is to produce power so that it can be transmitted to the boom, auxiliary, and main hoist drums and to the *swing mechanism* (fig. 4). The three most common ways of transmitting this power in cranes are mechanically, hydraulically, and electrically.

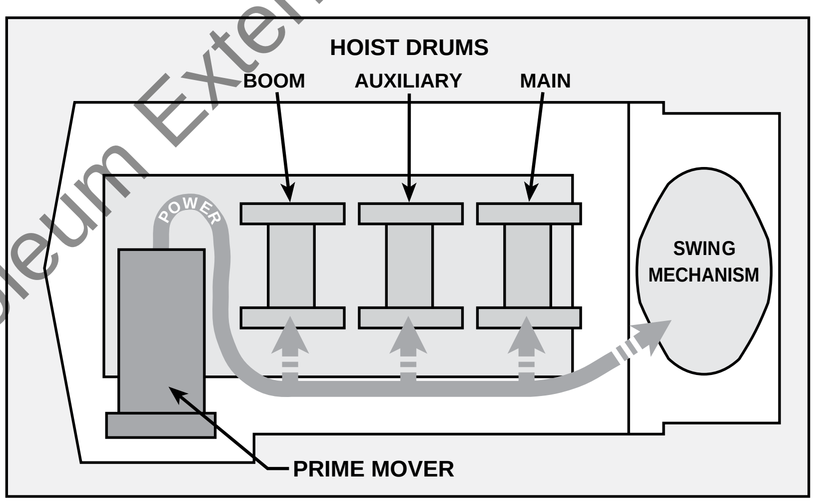


Figure 4. Power flows from the prime mover to the drums and swing mechanism.

Wire Rope and Fittings

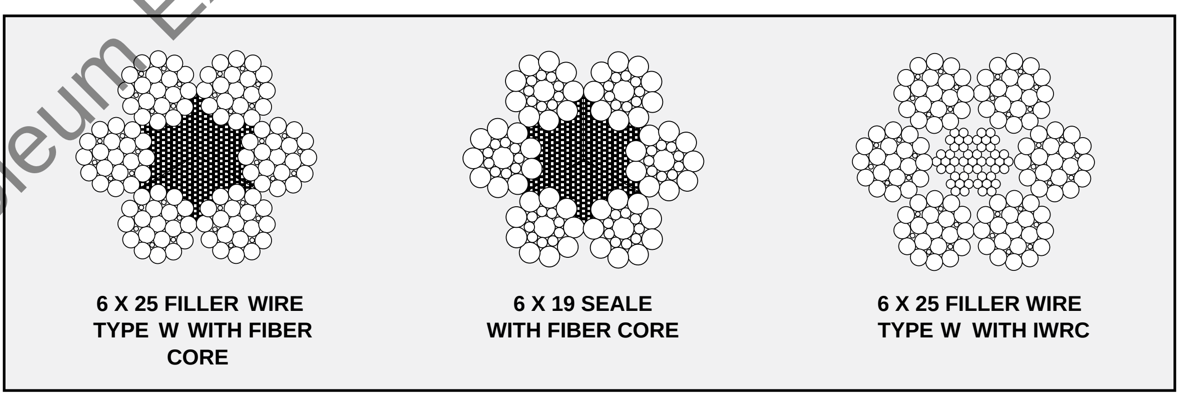
▼
▼
▼

A crane is not usable unless rigged for *hoisting*. For this function hoist lines are required. Hoist lines are made of *wire rope*, which is actually several steel strands wound around a central core. A look at some different designs will show details which characterize certain wire ropes.

Figure 23 shows cross sections of several types of wire rope. Note that each of the samples has six strands. The pattern at the bottom, labeled 6 × 25, is the design of wire rope most often used for hoist lines on pedestal cranes. Twenty-five wires are in each of these six strands. The strands surround a central core of IWRC, which stands for independent wire rope center. They are woven with 49 additional wires, which makes a total of 199 individual wires in this type rope. Each wire is usually made of improved plow steel, abbreviated IPS.

The more wires per strand in a wire rope the more flexible it will be. For example, a 6 × 37 wire rope is more flexible than a 6 × 19 wire rope. Six denotes number of strands and the next number, the number of wires per strand. Both are commonly used in oilfield work. For crane work it is desirable to use a nonrotating rope for load lines.

Figure 23. Different wire ropes have different purposes. The 6 x 25 is popular for hoist lines.



Hand Signals

▼
▼
▼

HOIST. With forearm vertical, forefinger pointing up, move hand in a small horizontal circle.

LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circles.

USE MAIN HOIST. Tap fist on head; then use regular signals.

USE WHIP LINE. (Auxiliary Hoist) Tap elbow with one hand, then use regular signals.

RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.

LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.

To obtain additional training materials, contact:

PETEX
THE UNIVERSITY OF TEXAS AT AUSTIN
PETROLEUM EXTENSION SERVICE
10100 Burnet Road, Bldg. 2
Austin, TX 78758

Telephone: 512-471-5940
or 800-687-4132
FAX: 512-471-9410
or 800-687-7839
E-mail: petex@www.utexas.edu
or visit our Web site: www.utexas.edu/ce/petex

To obtain information about training courses, contact:

PETEX
LEARNING AND ASSESSMENT CENTER
THE UNIVERSITY OF TEXAS
4702 N. Sam Houston Parkway West, Suite 800
Houston, TX 77086

Telephone: 281-397-2440
or 800-687-7052
FAX: 281-397-2441
E-mail: plach@www.utexas.edu
or visit our Web site: www.utexas.edu/ce/petex

ISBN 0-88698-179-4
9 780886 981792
2.50820
ISBN 0-88698-179-4