

FUNDAMENTAL MANUFACTURING PROCESSES

Thermal & Abrasive Waterjet Cutting - TWC

SCENE 1.

TWC17A, CGS: Oxy-Fuel Cutting
white text, centered on background
FMP BKG, motion background

SCENE 2.

TWC18A, **SME4441**, **08:54:34:00-08:54:54:00**
zoom out, oxy-fuel cutting of steel plate

NARRATION (VO):

OXYGEN-FUEL OR OXY-FUEL CUTTING WAS ONCE
THE ONLY FORM OF THERMAL CUTTING.

SCENE 3.

continue previous shot
TWC19A, ANI: cut away of two-part oxy-fuel
torch, exterior preheating flame
TWC19B, ANI: cut away of two-part oxy-fuel
torch, exterior preheating flame with jet
of oxygen at the center
TWC19C, **SME4443**, **11:01:26:00-11:01:56:00**
c.u. oxy-fuel flame cutting of steel plate

NARRATION (VO):

THE OXY-FUEL CUTTING PROCESS USES A TWO-
PART TORCH -- A PREHEATING EXTERIOR OXY-
FUEL FLAME, AND A JET OF HIGH-PURITY
OXYGEN AT THE CENTER. CUTTING OCCURS
FROM THE CHEMICAL REACTION BETWEEN
OXYGEN AND A READILY OXIDIZED METAL,
SUCH AS STEEL, IN THE PRESENCE OF HEAT.

SCENE 4.

continue previous shot
TWC20A, **SME4441**, **08:05:51:00-08:06:13:00**
zoom out, tanks of gas
TWC20C, **SME4441**, **08:01:03:00-08:03:17:00**
zoom out, torch started, metal brought to
kindling temperature, compressed oxygen
turned on, oxy-fuel cutting beginning
TWC20B, CGS: 1,650° Fahrenheit
900° Celsius
TWC20D, **SME4462**, **04:19:40:00-04:20:32:00**
zoom out, torch started, metal brought to
kindling temperature, compressed oxygen
turned on, oxy-fuel cutting beginning,
alternate shot

NARRATION (VO):

THE EXTERIOR FLAME IS PRODUCED BY A
MIXTURE OF OXYGEN AND A COMBUSTIBLE GAS
SUCH AS ACETYLENE, PROPANE, METHANE, OR
OTHER GAS. IT PREHEATS THE METAL TO ITS
'KINDLING TEMPERATURE', WHICH IS AROUND
1,650 DEGREES FAHRENHEIT, OR 900 DEGREES
CELSIUS. THIS IS THE TEMPERATURE AT
WHICH THE METAL REACTS QUICKLY WITH
OXYGEN.

SCENE 5.

continue previous shot

NARRATION (VO):

ONCE THE STARTING AREA REACHES THE
KINDLING TEMPERATURE, THE OPERATOR TURNS
ON THE JET OF COMPRESSED CUTTING OXYGEN.
THE OXYGEN STREAMS FROM THE TORCH TIP
INTO THE GLOWING-RED, PREHEATED METAL,
CAUSING A FAST COMBUSTION REACTION.

SCENE 6.

TWC22A, SME4441, 08:49:43:00-08:50:14:00
oxy-fuel cutting of metal

NARRATION (VO):

THE RESULTING MOLTEN MATERIAL IS BLOWN
THROUGH THE METAL BY THE STREAM OF
CUTTING OXYGEN, EXPOSING FRESH METAL FOR
CUTTING.

SCENE 7.

TWC23A, SME4447, 14:05:44:00-14:06:16:00
zoom out, oxy-fuel cutting operation
TWC23B, CGS: Oxygen Purity
Rate of Oxygen Supply
Torch Tip Size & Type
Distance from the Workpiece
Fuel Gas Type
Gas Flow Rates
Cutting Speed

NARRATION (VO):

MANY VARIABLES AFFECT THE OXY-FUEL CUT
QUALITY, INCLUDING OXYGEN PURITY, RATE
OF OXYGEN SUPPLY, TORCH TIP SIZE AND
TYPE, DISTANCE FROM THE WORKPIECE, FUEL
GAS TYPE, GAS FLOW RATES, AND CUTTING
SPEED.

SCENE 8.

TWC24A, SME4505, 11:04:20:00-11:04:40:00
oblique angle oxy-fuel cutting operation
TWC24B, CGS: Material Type
Surface Condition
Angle of the Cut
TWC24C, SME4443, 10:47:52:00-10:48:20:00
zoom out, oxy-fuel cutting operation,
alternate shot

NARRATION (VO):

OTHER MAJOR FACTORS IN OXY-FUEL CUT
QUALITY ARE THE MATERIAL TYPE, ITS
SURFACE CONDITION, AND THE ANGLE OF THE
CUT, IF IT IS OTHER THAN STRAIGHT.

SCENE 9.

TWC25A, SME4447, 14:46:53:00-14:47:12:00
oxy-fuel torch, preheating metal, cutting
through thick steel

NARRATION (VO):

OXY-FUEL CUTTING TORCHES SUPPLY THE
PROPER FUEL GAS-OXYGEN MIXTURE FOR
PREHEATING THE METAL, AND SUPPLY A

STEADY FLOW OF OXYGEN FOR THROUGH-CUTTING.

SCENE 10.

TWC26A, SME4447, 14:37:02:00-14:37:38:00
tip of oxy-fuel torch being replaced
TWC26B, torch tip/nozzle 01
TWC26C, torch tip/nozzle 02
TWC26D, torch tip/nozzle 03
TWC26E, torch tip/nozzle 04
TWC26F, SME4447, 14:01:38:00-14:01:56:00
zoom out, oxy-fuel operation ending

NARRATION (VO):

THE TORCH'S CUTTING TIP AND GAS PRESSURE DETERMINE THE CUTTING ACTION. CUTTING TIPS OR NOZZLES COME IN A VARIETY OF DESIGNS TO SERVE DIFFERENT CUTTING FUELS. THE DIAMETER OF THE CENTRAL JET OF OXYGEN MUST BE SELECTED IN PROPORTION TO THE DEPTH OF THE STOCK BEING CUT.

SCENE 11.

TWC27A, SME4462, 04:18:26:00-04:18:52:00
c.u., zoom out, red hot metal, compressed oxygen turned on, oxy-fuel cutting
TWC27B, SME4447, 14:54:47:00-14:55:09:00
zoom out, thick material being cut using oxy-fuel process
TWC27C, SME4443, 10:34:32:00-10:35:07:00
zoom in, thick material being cut using oxy-fuel process, alternate shot

NARRATION (VO):

THE TORCH TIP-TO-WORK STANDOFF DISTANCE IS ALSO DEPENDENT ON THE WORKPIECE THICKNESS. FOR THINNER MATERIAL, THE TIP IS KEPT CLOSE TO THE WORK AND MOVED RAPIDLY, WHILE FOR THICKER WORK, THE STANDOFF DISTANCE IS INCREASED.

SCENE 12.

continue previous shot
TWC28A, SME4443, 10:20:49:00-10:21:31:00
cutting starting on thick workpiece

NARRATION (VO):

ADDITIONALLY, THE THICKER THE CUT, THE MORE DIFFICULT IT BECOMES TO MAINTAIN CUT QUALITY. LARGER TORCH TIPS WITH GREATER OXYGEN FLOW ARE USED TO CUT THICK STOCK, CREATING A LARGER KERF, OR WIDTH OF CUT.

SCENE 13.

TWC29A, SME4462, 04:30:28:00-04:30:43:00
oxy-fuel cutting of thin plate

NARRATION (VO):

BY ADJUSTING THE CUTTING PARAMETERS IT IS POSSIBLE TO ACHIEVE A FAIRLY SMOOTH

EDGE AND A FAIRLY NARROW KERF.

SCENE 14.

TWC30A, SME4447, 14:39:42:00-14:40:23:00
med, piercing pilot hole in of thick
material

TWC30B, SME4447, 14:43:49:00-14:44:22:00
wide, piercing pilot hole in of thick
material, alternate shot

NARRATION (VO):

CUTS WITHIN EXTREMELY THICK MATERIAL ARE
COMMONLY STARTED BY PIERCING AN INITIAL
PILOT HOLE. THIS IS ACCOMPLISHED USING
PURE OXYGEN SUPPLIED THROUGH A TORCH TIP
THAT SERVES AS A LONG PIERCING TOOL. AS
THE PURE OXYGEN REACTS WITH THE
MATERIAL, THE TOOL IS FED THROUGH,
GENERATING THE PILOT HOLE.

SCENE 15.

TWC31A, SME4408, 10:17:43:00-10:18:05:00
oxy-fuel cutting using manual/portable
unit

TWC31B, SME4118, 08:09:05:00-08:09:46:00
oxy-fuel cutting using automated machine
with numerous cutting torches

NARRATION (VO):

OXY-FUEL CUTTING MACHINES RANGE FROM
MANUAL AND PORTABLE UNITS...,
TO LARGE AUTOMATED MACHINES WITH A
MOTOR-DRIVEN CARRIAGE AND NUMEROUS
CUTTING TORCHES.

SCENE 16.

continue previous shot
TWC32A, CGS: Torch Placement
Ignition
Fuel Pressure
Cutting Speed

NARRATION (VO):

MACHINES TYPICALLY HAVE ADJUSTMENTS FOR
TORCH PLACEMENT, IGNITION, FUEL
PRESSURE, AND CUTTING SPEED.

--- FADE TO BLACK ---