

## DAFTAR ISI

LEMBAR PENGESAHAN .....	ii
PERNYATAAN KEASLIAN KARYA ILMIAH .....	iii
HALAMAN PERSEMBERAHAN.....	iv
PRAKATA .....	v
RINGKASAN.....	vi
ABSTRACT .....	vii
DAFTAR ISI .....	xi
DAFTAR GAMBAR.....	xiii
DAFTAR TABEL .....	xiv
DAFTAR GRAFIK .....	xv
DAFTAR LAMPIRAN .....	xii
DAFTAR SINGKATAN DAN LAMBANG .....	xiii
BAB I PENDAHULUAN .....	15
I.1 Latar Belakang.....	15
I.2 Maksud dan Tujuan .....	16
I.2.1 Maksud .....	16
I.2.2 Tujuan .....	16
I.3 Batasan Masalah .....	16
I.4 Metodologi.....	17
I.5 Hasil yang Diharapkan .....	20
I.6 Sistematika Penulisan .....	20
BAB II TINJAUAN LAPANGAN .....	21
II.1 Tinjauan Geografis Lapangan “Krajan” .....	21
II.2 Tinjauan Geologi Lapangan “Krajan”.....	23
II.3 <i>Petroleum System</i> Lapangan “Krajan” .....	27
II.4 Permasalahan <i>Subsurface</i> Lapangan “Krajan” .....	29
II.5 Kronologi Terjepitnya <i>Casing</i> Pada <i>Hole Size 12 ¼”</i> Sumur “B-6” .....	29
BAB III DASAR TEORI PROBLEM PIPE STICKING .....	31
III.1 Jenis dan Faktor Penyebab Terjadinya Pipa Terjepit.....	32

III.1.1 <i>Mechanical Pipe Sticking</i> .....	33
III.1.2 <i>Differential Pipe Sticking</i> .....	47
III.1.3 Penyebab Terjadinya <i>Pipe sticking</i> .....	49
III.1.4 Analisa Lithologi Pemboran .....	55
III.2 Analisa Densitas Fluida Pemboran .....	56
III.3 Analisa <i>Dogleg Severity</i> .....	59
III.4 Analisa Pengangkatan <i>Cutting</i> .....	61
III.5 Tanda-Tanda Terjadinya <i>Pipe sticking</i> .....	66
III.5.1 <i>Revolution Per Minute (RPM)</i> .....	67
III.5.2 <i>Torsi</i> .....	67
III.5.3 <i>Rate Of Penetration (ROP)</i> .....	68
III.6 Metode Pembebasan <i>Pipe sticking</i> .....	68
III.6.1 Penentuan <i>Margin of Overpull</i> .....	69
III.6.2 Menurunkan Tekanan Hidrostatis .....	72
III.6.3 Metode Regang Lepas ( <i>Work on Pipe</i> ) .....	73
III.6.4 Sirkulasi <i>High Viscosity</i> .....	73
III.6.5 <i>Spotting Fluids</i> .....	73
III.6.6 <i>Back Off Operation</i> .....	75
BAB IV ANALISA PROBLEM CASING STUCK.....	77
IV.1 Profil Sumur.....	77
IV.2 Analisa Penyebab Terjadinya <i>Casing Stuck</i> .....	82
IV.2.1 Analisa <i>Differential Pipe Sticking</i> .....	83
IV.2.2 Analisa <i>Mechanical Pipe Sticking</i> .....	89
IV.3 Analisa Tanda-Tanda Terjadinya <i>Pipe Sticking</i> .....	104
IV.4 Analisa Penanggulangan <i>Pipe Sticking</i> .....	105
BAB V PEMBAHASAN .....	113
BAB VI KESIMPULAN DAN SARAN.....	117
DAFTAR RUJUKAN .....	118
LAMPIRAN .....	123

## DAFTAR GAMBAR

Gambar I.1 Diagram <i>flowchart</i> .....	19
Gambar II.1 Peta Lokasi Lapangan “Krajan”.....	22
Gambar II.2 Titik Sumur di Lapangan Krajan .....	22
Gambar II.3 Struktur Regional Blok Cepu.....	25
Gambar III.1 <i>Mechanical pipe sticking</i> disebabkan <i>cutting</i> : (a) <i>cuttings bed</i> ketika pemboran berjalan, dan (b) <i>cutting jamming</i> saat <i>tripping out</i> .....	36
Gambar III.2 <i>Splintery Caving/Cutting</i> .....	37
Gambar III.3 Struktur 1:1 <i>Kaolinite</i> .....	38
Gambar III.4 <i>Collapse of Unconsolidation Formations</i> .....	41
Gambar III.5 <i>Undergauge Hole</i> .....	42
Gambar III.6 <i>Junk</i> .....	42
Gambar III.7 <i>Green Cement</i> .....	43
Gambar III.8 <i>Collapsed Casing</i> .....	43
Gambar III.9 <i>Differential Pipe Sticking</i> .....	48
Gambar III.10 <i>Stretch Method</i> .....	51
Gambar III.11 <i>Free Point Tool</i> .....	54
Gambar III.12 API Recommended Mechanical Properties of Drill Pipe.....	70

## DAFTAR TABEL

Tabel II-1 Koordinat Lapangan “Krajan”.....	21
Tabel III-1 <i>Pipe sticking Mechanism and Cause</i> .....	33
Tabel III-2 CEC ( <i>Cation Exchange Capacity</i> ) Mineral <i>Clay</i> .....	37
Tabel III-3 Klasifikasi <i>shale</i> berdasarkan analisa MBT dan XRD.....	39
Tabel III-4 Klasifikasi <i>Shale Problem</i> .....	40
Tabel III-5 <i>Drill Pipe Strech Table</i> .....	53
Tabel III-6 <i>Stuck Pipe Problem and Indicator</i> .....	67
Tabel IV-1 Formasi yang ditembus sumur “B-6” .....	79
Tabel IV-2 <i>Hole Section &amp; Mud Summary</i> Sumur “B-6” .....	80
Tabel IV-3 Data <i>Problem</i> untuk Analisa Lithologi .....	84
Tabel IV-4 Riwayat Problem pada <i>Hole Size</i> 12 ¼” .....	91
Tabel IV-5 Data Lumpur .....	94
Tabel IV-6 <i>Clasification of Problem Shales</i> .....	95
Tabel IV-7 <i>Clasification of Hole Problem (Shale)</i> .....	95
Tabel IV-8 Tabulasi Hasil Analisa Pengangkatan <i>Cutting</i> .....	100
Tabel IV-9 Perhitungan <i>Hole Cleaning</i> pada <i>Hole Size</i> 12 ¼” .....	100
Tabel IV-10 Data <i>Wellbore geometry</i> .....	101
Tabel IV-11 <i>Actual Wellpath Hole Size</i> 12 1/4”.....	103
Tabel IV-12 Jenis <i>pipe sticking</i> berdasarkan indikasi atau tanda-tandanya .....	104
Tabel IV-13 Upaya Pencegahan oleh Perusahaan.....	112

## **DAFTAR GRAFIK**

Grafik IV-1 PPFG Sumur <i>Existing</i> Lapangan “Krajan” .....	78
Grafik IV-2 PPFG Program Sumur “B-6”.....	79
Grafik IV-3 PPFG <i>Offset Well</i> (B-4) untuk Sumur ”B-6” .....	88

## **DAFTAR LAMPIRAN**

Lampiran A <i>Drilling Well Phase</i> .....	124
Lampiran B <i>Drilling Well Phase</i> .....	125
Lampiran C <i>WellPath Aktual</i> .....	126
Lampiran D Data <i>Logging</i> .....	130
Lampiran E Data Riwayat Problem pada trayek 12 ¼” .....	131
Lampiran F Data PPFG Planning Sumur B-6 Berdasarkan Existing Well .....	133

## **DAFTAR SINGKATAN DAN LAMBANG**

### **SINGKATAN**

MD	<i>Measured Depth</i>
NPT	<i>Non-Productive Time</i>
BHA	<i>Bottom Hole Assembly</i>
ECD	<i>Equivalent Circulating Density</i>
ESD	<i>Equivalent Static Density</i>
MWD	<i>Measurement While Drilling</i>
LWD	<i>Logging While Drilling</i>
HWDP	<i>Heavy Weight Drillpipe</i>
MBT	<i>Methelyene Blue Test</i>
XRD	<i>X-Ray Diffraction</i>
CEC	<i>Cation Exchange Capacity</i>
SC	<i>Stretch Constant</i>
FPC	<i>Free point constant</i>
LSM	<i>Linear Swell Meter</i>
ROP	<i>Rate Of Penetration</i>
RPM	<i>Revolution Per Minute</i>
WOB	<i>Weight On Bit</i>
EMW	<i>Equivalent Mud Weight</i>
TVD	<i>True Vertical Depth</i>
MW	<i>Mud Weight</i>
Pf	<i>Formation Pressure</i>
Ph	<i>Hydrostatic Pressure</i>
DLS	<i>Dogleg Severity</i>
OD	<i>Outside Diameter</i>
ID	<i>Inside Diameter</i>
PV	<i>Plastic Viscosity</i>
YP	<i>Yield Point</i>

## SINGKATAN

PBI	<i>Particle Bed Index</i>
MOP	<i>Margin Of Overpull</i>
BF	<i>Bouyancy Factor</i>
BUR	<i>Build up Ratio</i>
KOP	<i>Kick Of Point</i>
WBM	<i>Water Base Mud</i>

## LAMBANG

$\Delta L$	<i>Pemanjangan (Stretch)</i>
d	<i>d-exponent</i>
$\Delta P$	<i>Differential Pressure</i>
$\alpha$	<i>Perubahan sudut inklinasi</i>
$\beta$	<i>Perubahan sudut arah (azimuth)</i>
$\sigma_t$	<i>Tensille stress dari beban drillstring</i>
$\sigma_b$	<i>Bending stress yang diijinkan</i>
c	<i>Maximum dogleg severity</i>
$\rho_m$	<i>Densitas lumpur</i>
$\rho_m$	<i>Densitas Besi</i>
n	<i>Power Law Indeks</i>
K	<i>Consistency Indeks</i>
$\theta$	<i>Inklinasi</i>