

# USULAN PERBAIKAN POSTUR TUBUH OPERATOR BAGIAN MESIN JAHIT BERDASARKAN METODE *QUICK EXPOSURE CHECK* DI PD X

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## ABSTRAK

*Perusahaan koveksi tas X memiliki beberapa permasalahan terkait beban kerja operator pada stasiun kerja sehingga perlu ditinjau kembali mengenai keluhan operator dalam melakukan pekerjaannya. Tingkat kelelahan dapat berpengaruh pada kualitas produk yang akan dihasilkan, dan kesehatan dan keselamatan kerja operator merupakan salah satu faktor penting yang harus dijaga oleh pihak perusahaan. Pada stasiun kerja mesin jahit memiliki posisi bekerja membungkuk dan kegiatan yang dilakukan terus menerus. Untuk meminimalisir hal tersebut perlu dilakukan penelitian terkait keluhan operator dengan menggunakan metode Quick Exposure Check (QEC). Quick Exposure Check (QEC) merupakan suatu metode yang digunakan untuk mengukur tingkat kelelahan operator. Metode ini merupakan metode yang dapat mempertimbangkan kondisi operator berdasarkan sudut pandang pengamat dan operator. Hasil perhitungan nilai yang didapatkan dari stasiun kerja mesin jahit berada pada klasifikasi 50-69% yang artinya perlu dilakukan penelitian lebih lanjut dan perbaikan karena stasiun kerja kurang baik dan mulai timbulnya keluhan dari operator. Usulan yang diberikan adalah dengan memperbaiki postur tubuh operator saat bekerja atau dengan memberikan sandaran dan tambahan busa pada dudukan kursi.*

**Kata kunci:** *Beban Kerja Operator, ergonomi, Quick Exposure Check (QEC)*

## ABSTRACT

*Bag repair company X has several problems related to operator workload at work stations, so it needs to be reviewed regarding operator complaints in carrying out their work. The level of fatigue can affect the quality of the product to be produced, and the health and safety of operators is one of the important factors that must be maintained by the company. At the sewing machine work station has a bent working position and activities that are carried out continuously. To minimize this, it is necessary to conduct research related to operator complaints using Quick Exposure Check (QEC) approach. Quick Exposure Check (QEC) is a method used to measure the level of operator fatigue. This method assesses a condition of the working operators based on their point of view and that observer. The results of calculating the value obtained from the sewing machine work station are in the 50-*

*69% classification, which means that further research and improvement is needed because the work station is not good enough and complaints from operators are starting to arise. The suggestion is given either to improve the operators' posture while working or to provide a additional foam in the chair seat as a backrest.*

**Keywords: Operator Workload, Ergonomics, Quick Exposure Check (QEC)**

## 1. PENDAHULUAN

PD X merupakan perusahaan yang bergerak dalam bidang konveksi. Perusahaan tersebut memproduksi beberapa jenis tas, yaitu tas dewasa, tas anak-anak, tas gitar, sling bag, dan lain-lain. Proses produksi yang ada pada PD. X dilakukan dengan cara proses permesinan dan proses yang dilakukan oleh operator. Berdasarkan pengamatan yang dilakukan di PD X, terdapat beberapa permasalahan yang ditemukan. Salah satu permasalahan yang terjadi berkaitan dengan posisi kerja operator yang tidak ENASE pada stasiun kerja mesin jahit. Hal ini dikarenakan posisi kerja operator yang membungkuk dan kegiatan ini dilakukan secara terus menerus sehingga dapat mempengaruhi performansi mereka.

Berdasarkan hasil wawancara dengan operator stasiun kerja mesin jahit, operator yang berkerja pada stasiun kerja ini sering merasakan pegal hingga nyeri mulai dari kaki, punggung dan leher operator. Dampak dari keluhan operator tersebut dapat mempengaruhi produktifitas kerja dan kesehatan pada operator. Untuk mengatasi masalah yang terjadi dalam perusahaan perlu dilakukan penelitian terkait keluhan operator dengan menggunakan metode *Quick Exposure Check (QEC)*. *Quick Exposure Check (QEC)* merupakan suatu metode yang digunakan untuk mengukur tingkat kelelahan operator. Metode ini merupakan metode yang dapat mempertimbangkan kondisi operator berdasarkan sudut pandang pengamat dan operator.

## 2. METODOLOGI

### 2.1 Identifikasi Masalah

Salah satu permasalahan yang terjadi dan perlu dilakukan perbaikan adalah permasalahan yang berkaitan dengan posisi kerja operator yang tidak ENASE pada stasiun mesin jahit karena posisi kerja operator yang membungkuk dan kegiatan yang dilakukan terus menerus. Permasalahan ini dapat mempengaruhi performansi operator ketika berkerja. Beberapa keluhan disampaikan oleh operator mesin jahit seperti sering merasakan pegal hingga nyeri mulai dari kaki, punggung dan leher operator. Permasalahan ini perlu diselesaikan oleh PD X agar posisi kerja operator mesin jahit lebih ENASE dan dapat meningkatkan kinerja operator saat bekerja.

### 2.2 Studi Literatur

#### 2.2.1 Ergonomi

Ergonomi adalah suatu aturan atau norma dalam sistem kerja. Kata "ergonomi" berasal dari kata Yunani yaitu "ergon" berarti kerja dan "nomos" berarti hukum alam, dapat didefinisikan sebagai studi tentang aspek manusia dalam lingkungan kerjanya yang ditinjau secara anatomi, fisiologi, psikologi, engineering, manajemen dan perancangan dan desain (Nurmianto, 1996). Ergonomi adalah ilmu, seni dan penerapan teknologi untuk menyaserasikan atau menyeimbangkan antara segala fasilitas yang digunakan baik dalam beraktivitas maupun

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istirahat dengan kemampuan dan keterbatasan manusia baik fisik maupun mental sehingga kualitas hidup secara keseluruhan menjadi lebih baik (Tarwaka, dkk, 2004).

## 2.2.2 Quick Exposure Check (QEC)

*Quick Exposure Check* (QEC) merupakan metode pengukuran beban postur yang digunakan untuk mengetahui risiko cedera gangguan otot rangka (musculoskeletal disorder) yang menitik beratkan pada tubuh bagian atas yaitu punggung, leher, lengan, bahu, dan pergelangan tangan (Li dan Buckle, 1998). Kelebihan dari metode ini adalah mempertimbangkan kondisi yang dialami oleh pekerja dari dua sudut pandang yaitu dari sudut pandang pengamat dan juga operator. Hal ini dapat memperkecil bisa penilaian subjektif dari pengamat.

## 2.3 Penentuan Metode Pemecah Masalah

Metode yang cocok untuk memecahkan permasalahan yang ada di PD X adalah *Quick Exposure Check* (QEC) karena merupakan metode yang dapat mempertimbangkan kondisi operator berdasarkan sudut pandang pengamat dan operator.

## 2.4 Pengumpulan dan Pengolahan Data *Quick Exposure Check*

Tahapan-tahapan yang diperlukan pada metode *Quick Exposure Check* (QEC) yaitu sebagai berikut.

1. Mengumpulkan data dari hasil kuesioner pengamat dan operator.

Contoh kuesioner pengamat, kuesioner operator, dan rekapitulasi matriks dapat dilihat pada Gambar 1, Gambar 2, dan Gambar 3.

| KUESIONER PENGAMAT |                   |
|--------------------|-------------------|
| NAMA OPERATOR      | NAMA PENGAMAT     |
| NRP                | NRP               |
|                    | TANGGAL PENGISIAN |

  

| PUNGGUNG |  |
|----------|--|
| A        | KETIKA MELAKUKAN PEKERJAAN, APAKAH PUNGGUNG... (PILIH KONDISI TERBUKUK)  |
| A1       | HAMPIR NETRAL  |
| A2       | AGAK MEMUTAR ATAU MEMBUNGKUK   |
| A3       | TERLALU MEMUTAR DAN MEMBUNGKUK   |
| B        | PILIH SALAH SATU DARI 2 PILIHAN BERIKUT  |
|          | UNTUK PEKERJAAN DALAM KEADAAN DUDUK ATAU BERDIRI SECARA STATIS, APAKAH PUNGGUNG BERADA PADA KONDISI STATIS YANG LAMAR? |
| B1       | TIDAK  |
| B2       | YA   |
| ATAU     | UNTUK PEKERJAAN MENGANGKAT, MENDORONG/MENARIK, APAKAH PERGERAKAN PADA PUNGGUNG   |
| B3       | JARANG (= 3 KALI PER MENIT)  |
| B4       | SERING (ANTARA 4 SAMPAI 12 KALI PER MENIT)   |
| B5       | SANGAT SERING (LEBIH DARI 12 KALI PER MENIT)   |

  

| BAHU/LENGAN |   |
|-------------|---|
| C           | KETIKA PEKERJAAN DILAKUKAN, APAKAH TANGAN... (PILIH KONDISI TERBUKUK) |
| C1          | BERADA DI SEKITAR PINGGANG ATAU LEBIH RENDAH                          |
| C2          | BERADA DI SEKITAR DADA  |
| C3          | BERADA DI SEKITAR BAHU ATAU LEBIH TINGGI                              |
| D           | APAKAH PERGERAKAN BAHU/LENGAN   |
| D1          | JARANG  |
| D2          | SERING (PERGERAKAN BIJASA SESELANGI DENGAN BERHENTI SESAT)            |
| D3          | SERING (PERGERAKAN SECARA TERUS MENERUS)                              |

  

| PERGELANGAN TANGAN/TANGAN |   |
|---------------------------|---|
| E                         | APAKAH PEKERJAAN DILAKUKAN DENGAN... (PILIH SITUASI TERBUKUK) |
| E1                        | PERGERAKAN TANGAN HAMPIR LURUS                                |
| E2                        | PERGELANGAN TANGAN TERTEKUK                                   |
| F                         | APAKAH GERAKAN PEKERJAAN DILAKUKAN SECARA BERULANG            |
| F1                        | 10 KALI PER MENIT ATAU KURANG                                 |
| F2                        | ANTARA 11 SAMPAI 20 KALI PER MENIT                            |
| F3                        | LEBIH DARI 20 KALI PER MENIT                                  |

  

| LEHER |  |
|-------|--|
| G     | KETIKA MELAKUKAN PEKERJAAN, APAKAH LEHER/NEPALA TERTEKUK ATAU BERPUTAR |
| G1    | TIDAK  |
| G2    | YA, TERKADANG  |
| G3    | YA, SECARA TERUS MENERUS   |

Gambar 1. Kuesioner Pengamat

**KUESIONER OPERATOR**

NAMA OPERATOR \_\_\_\_\_

NRP \_\_\_\_\_

TANGGAL PENGISIAN \_\_\_\_\_

H APAKAH BERAT MAKSIMUM YANG DIANGKAT SECARA MANUAL OLEH ANDA PADA PEKERJAAN INI

H1  RINGAN (KURANG DARI 5 KG)

H2  CUKUP BERAT (6 - 10 KG)

H3  BERAT (11 - 20 KG)

H4  SANGAT BERAT (LEBIH DARI 20 KG)

I BERAPA LAMA WAKTU YANG ANDA HABISKAN DALAM MELAKUKAN PEKERJAAN INI SELAMA SATU HARI

I1  KURANG DARI 2 JAM

I2  2 HINGGA 4 JAM

I3  LEBIH DARI 4 JAM

J KETIKA MELAKUKAN PEKERJAAN INI BERAPA TINGKAT KEKUATAN YANG DIGUNAKAN OLEH SATU TANGAN

J1  RENDAH (KURANG DARI 1 KG)

J2  SEDANG (ANTARA 1 SAMPAI 4 KG)

J3  TINGGI (LEBIH DARI 4KG)

K APAKAH PEKERJAAN INI MEMERLUKAN PENGIHATAN YANG

K1  RENDAH (TIDAK PERLU PENGIHATAN SECARA DETAIL)

K2  TINGGI (PERLU PENGIHATAN SECARA DETAIL)

L KETIKA BEKERJA ANDA MENGGUNAKAN KENDARAAN SELAMA

L1  KURANG DARI 1 JAM PER HARI ATAU TIDAK PERNAH

L2  ANTARA 1 SAMPAI 4 JAM PER HARI

L3  LEBIH DARI 4 JAM PER HARI

M KETIKA BEKERJA APAKAH ANDA MENGGUNAKAN ALAT YANG MENGHASILKAN GETARAN SELAMA

M1  KURANG DARI 1 JAM PER HARI ATAU TIDAK PERNAH

M2  ANTARA 1 SAMPAI 4 JAM PER HARI

M3  LEBIH DARI 4 JAM PER HARI

N APAKAH ANDA MENGALAMI KESULITAN DALAM MELAKUKAN PEKERJAAN INI

N1  TIDAK

N2  TERKADANG

N3  SERING

O PADA UMUMNYA, BAGAIMANA ANDA MENJALANI PEKERJAAN INI

O1  SAMA SEKALI TIDAK STRESS

O2  CUKUP STRESS

O3  STRESS

O4  SANGAT STRESS

Gambar 2. Kuesioner Operator

| EXPOSURE SCORE   |    |    | BAHU/LENGGAN |    |    | PERGELANGAN TANGAN |   |    | LEHER |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
|--|----|----|--------------|----|----|--------------------|---|----|-------|----|----|---|---|---|---|---|----|--|----|----|--------------------------|--|----|----|----|----|----|----|---|---|----|----|---|----|----|--|---|---|----|---|----|----|----|--|----|----|----|----|----|--|----|---|----|--|----|----|----|----|----|----|----|--|---|----|----|----|----|----|---|---|----|----|---|---|---|----|---|---|----|
| NAMA OPERATOR _____<br>NRP _____<br>TANGGAL PENGISIAN _____  |    |    |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>POSISI PUNGUNG (A) DAN BEBAN (H)</b><br><table border="1"> <tr><th>A1</th><th>A2</th><th>A3</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 1 |    |    | A1           | A2 | A3 | H1                 | 2 | 4  | 6     | H2 | 4  | 6 | 8 | H3  | 6 | 8 | 10 | H4   | 8  | 10 | 12                       | <b>TINGGI (C) DAN BEBAN (H)</b><br><table border="1"> <tr><th>C1</th><th>C2</th><th>C3</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 1 |    |    | C1 | C2 | C3 | H1 | 2 | 4 | 6  | H2 | 4 | 6  | 8  | H3   | 6 | 8 | 10 | H4  | 8  | 10 | 12 | <b>GERAKAN BERULANG (F) DAN KEKUATAN (I)</b><br><table border="1"> <tr><th>F1</th><th>F2</th><th>F3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2 |    |    | F1 | F2 | F3 | I1   | 2  | 4 | 6  | I2   | 4  | 6  | 8  | I3 | 6  | 8  | 10 | <b>POSI LEHER (G) DAN DURASI (I)</b><br><table border="1"> <tr><th>G1</th><th>G2</th><th>G3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2 |   |    | G1 | G2 | G3 | I1 | 2 | 4 | 6  | I2 | 4 | 6 | 8 | I3 | 6 | 8 | 10 |
| A1   | A2 | A3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| C1   | C2 | C3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| F1   | F2 | F3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| G1   | G2 | G3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>POSISI PUNGUNG (A) DAN DURASI (I)</b><br><table border="1"> <tr><th>A1</th><th>A2</th><th>A3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2   |    |    | A1           | A2 | A3 | I1                 | 2 | 4  | 6     | I2 | 4  | 6 | 8 | I3  | 6 | 8 | 10 | <b>TINGGI (C) DAN DURASI (I)</b><br><table border="1"> <tr><th>C1</th><th>C2</th><th>C3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2 |    |    | C1                       | C2   | C3 | I1 | 2  | 4  | 6  | I2 | 4 | 6 | 8  | I3 | 6 | 8  | 10 | <b>GERAKAN BERULANG (F) DAN DURASI (I)</b><br><table border="1"> <tr><th>F1</th><th>F2</th><th>F3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2 |   |   | F1 | F2  | F3 | I1 | 2  | 4  | 6  | I2 | 4  | 6  | 8  | I3   | 6  | 8 | 10 | <b>KEBUTUHAN VISUAL (K) DAN DURASI (I)</b><br><table border="1"> <tr><th>K1</th><th>K2</th></tr> <tr><td>I1</td><td>2</td><td>4</td></tr> <tr><td>I2</td><td>4</td><td>6</td></tr> <tr><td>I3</td><td>6</td><td>8</td></tr> </table> SCORE 4                       |    |    | K1 | K2 | I1 | 2  | 4  | I2   | 4 | 6  | I3 | 6  | 8  |    |   |   |    |    |   |   |   |    |   |   |    |
| A1   | A2 | A3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| C1   | C2 | C3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| F1   | F2 | F3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| K1   | K2 |    |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>DURASI (I) DAN BEBAN (H)</b><br><table border="1"> <tr><th>I1</th><th>I2</th><th>I3</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 3         |    |    | I1           | I2 | I3 | H1                 | 2 | 4  | 6     | H2 | 4  | 6 | 8 | H3  | 6 | 8 | 10 | H4   | 8  | 10 | 12                       | <b>DURASI (I) DAN BEBAN (H)</b><br><table border="1"> <tr><th>I1</th><th>I2</th><th>I3</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 3 |    |    | I1 | I2 | I3 | H1 | 2 | 4 | 6  | H2 | 4 | 6  | 8  | H3   | 6 | 8 | 10 | H4  | 8  | 10 | 12 | <b>DURASI (I) DAN KEKUATAN (I)</b><br><table border="1"> <tr><th>I1</th><th>I2</th><th>I3</th></tr> <tr><td>J1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>J2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>J3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 2           |    |    | I1 | I2 | I3 | J1   | 2  | 4 | 6  | J2   | 4  | 6  | 8  | J3 | 6  | 8  | 10 | <b>TOTAL SCORE</b> _____   |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | I2 | I3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | I2 | I3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | I2 | I3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| J1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| J2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| J3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>POSISI STATIS (B) DAN DURASI (I)</b><br><table border="1"> <tr><th>B1</th><th>B2</th></tr> <tr><td>I1</td><td>2</td><td>4</td></tr> <tr><td>I2</td><td>4</td><td>6</td></tr> <tr><td>I3</td><td>6</td><td>8</td></tr> </table> SCORE 4  |    |    | B1           | B2 | I1 | 2                  | 4 | I2 | 4     | 6  | I3 | 6 | 8 | <b>FREKUENSI (D) DAN BEBAN (H)</b><br><table border="1"> <tr><th>D1</th><th>D2</th><th>D3</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 4 |   |   | D1 | D2   | D3 | H1 | 2                        | 4  | 6  | H2 | 4  | 6  | 8  | H3 | 6 | 8 | 10 | H4 | 8 | 10 | 12 | <b>POSISI PERGELANGAN TANGAN (E) DAN KEKUATAN (I)</b><br><table border="1"> <tr><th>E1</th><th>E2</th></tr> <tr><td>I1</td><td>2</td><td>4</td></tr> <tr><td>I2</td><td>4</td><td>6</td></tr> <tr><td>I3</td><td>6</td><td>8</td></tr> </table> SCORE 4                                |   |   | E1 | E2  | I1 | 2  | 4  | I2   | 4  | 6  | I3 | 6  | 8  | <b>SETARAN</b><br><table border="1"> <tr><th>M1</th><th>M2</th><th>M3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE |    |   | M1 | M2   | M3 | I1 | 2  | 4  | 6  | I2 | 4  | 6  | 8 | I3 | 6  | 8  | 10 |    |   |   |    |    |   |   |   |    |   |   |    |
| B1   | B2 |    |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| D1   | D2 | D3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| E1   | E2 |    |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| M1   | M2 | M3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>FREKUENSI (B) DAN BEBAN (H)</b><br><table border="1"> <tr><th>B3</th><th>B4</th><th>B5</th></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> SCORE 5      |    |    | B3           | B4 | B5 | H1                 | 2 | 4  | 6     | H2 | 4  | 6 | 8 | H3  | 6 | 8 | 10 | H4   | 8  | 10 | 12                       | <b>FREKUENSI (D) DAN DURASI (I)</b><br><table border="1"> <tr><th>D1</th><th>D2</th><th>D3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 5  |    |    | D1 | D2 | D3 | I1 | 2 | 4 | 6  | I2 | 4 | 6  | 8  | I3   | 6 | 8 | 10 | <b>POSISI PERGELANGAN TANGAN (E) DAN DURASI (I)</b><br><table border="1"> <tr><th>E1</th><th>E2</th></tr> <tr><td>I1</td><td>2</td><td>4</td></tr> <tr><td>I2</td><td>4</td><td>6</td></tr> <tr><td>I3</td><td>6</td><td>8</td></tr> </table> SCORE 4 |    |    | E1 | E2   | I1 | 2  | 4  | I2 | 4  | 6  | I3 | 6 | 8  | <b>KECEPATAN BEKERJA</b><br><table border="1"> <tr><th>N1</th><th>N2</th><th>N3</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE |    |    | N1 | N2 | N3 | I1 | 2  | 4  | 6 | I2 | 4  | 6  | 8  | I3 | 6 | 8 | 10 |    |   |   |   |    |   |   |    |
| B3   | B4 | B5 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| H4   | 8  | 10 | 12           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| D1   | D2 | D3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| E1   | E2 |    |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| N1   | N2 | N3 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| <b>FREKUENSI (B) DAN DURASI (I)</b><br><table border="1"> <tr><th>B3</th><th>B4</th><th>B5</th></tr> <tr><td>I1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>I2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>I3</td><td>6</td><td>8</td><td>10</td></tr> </table> SCORE 6  |    |    | B3           | B4 | B5 | I1                 | 2 | 4  | 6     | I2 | 4  | 6 | 8 | I3  | 6 | 8 | 10 | <b>TOTAL SCORE</b> _____   |    |    | <b>TOTAL SCORE</b> _____ |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| B3   | B4 | B5 |              |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I1   | 2  | 4  | 6            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I2   | 4  | 6  | 8            |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |
| I3   | 6  | 8  | 10           |    |    |                    |   |    |       |    |    |   |   |   |   |   |    |  |    |    |                          |  |    |    |    |    |    |    |   |   |    |    |   |    |    |  |   |   |    |   |    |    |    |  |    |    |    |    |    |  |    |   |    |  |    |    |    |    |    |    |    |  |   |    |    |    |    |    |   |   |    |    |   |   |   |    |   |   |    |

Gambar 3. Rekapitulasi Matriks

2. Hasil data kuesioner pengamat dan operator diolah untuk menghitung *exposure score* pada setiap anggota tubuh yang telah diamati. Berikut dapat dilihat tentang klasifikasi risiko dari nilai *Quick Exposure Check* (QEC) yang ada pada Tabel 1.

**Tabel 1. Klasifikasi Risiko (David, Woods, dan Buckle, 2005)**

| Anggota Tubuh      | Exposure Score |          |       |           |
|--------------------|----------------|----------|-------|-----------|
|                    | Low            | Moderate | High  | Very High |
| Punggung (Statis)  | 8-15           | 16-22    | 23-28 | 29-42     |
| Punggung (Dinamis) | 10-20          | 21-30    | 31-40 | 41-56     |
| Bahu/Lengan        | 10-20          | 21-30    | 31-40 | 41-56     |
| Pergelangan Tangan | 10-20          | 21-30    | 31-40 | 41-56     |
| Leher              | 4-6            | 8-10     | 12-14 | 16-18     |

3. Menghitung nilai exposure level untuk dapat mengetahui tindakan yang harus dilakukan berdasarkan hasil nilai total exposure check.

Exposure level (E) dihitung berdasarkan presentase antara total skor aktual exposure (X) dengan total skor maksimum (Xmaks).

$$E (\%) = \frac{X}{X_{max}} \times 100\% \quad (1)$$

Dimana :

X : total skor yang didapat dari penilaian terhadap postur (punggung + bahu/lengan + pergelangan tangan + leher)

Xmaks : total skor maksimum untuk postur kerja (punggung + bahu/lengan + pergelangan tangan + leher)

Xmaks adalah konstan untuk tipe-tipe tugas tertentu. Pemberian skor (Xmaks = 162) apabila tubuh adalah statis, termasuk duduk atau berdiri tanpa pengulangan (repetitive) yang sering dan penggunaan tenaga atau beban yang relatif lebih rendah. Berikut ini merupakan klasifikasi dari nilai exposure level yang dapat dilihat pada Tabel 2.

**Tabel 2. Klasifikasi Nilai Exposure Level (David, Woods, dan Buckle, 2005)**

| Total Exposure | Tindakan  |
|----------------|---|
| <40%           | Aman atau dapat diterima                              |
| 40-49%         | Perlu penelitian lebih lanjut                         |
| 50-69%         | Perlu penelitian lebih lanjut dan dilakukan perubahan |
| ≥70%           | Dilakukan penelitian dan perubahan secepatnya         |

## 2.7 Analisis Masalah dan Usulan Perbaikan

Tahap ini berisi hasil analisis yang dilakukan terhadap hasil perhitungan Quick Exposure Check dan usulan perbaikannya.

## 2.8 Kesimpulan dan Saran

Pada tahap ini merupakan kesimpulan dan saran yang diberikan kepada PD X.

## 3. HASIL PENELITIAN DAN ANALISIS

### 3.1 Pengumpulan dan Pengolahan Data

1. Data kuesioner pengamat dan operator

Berikut merupakan hasil kuesioner *Quick Exposure Check* (QEC) yang diisi oleh pengamat dan operator. Operator yang melakukan pengisian kuesioner adalah operator pada stasiun kerja

mesin jahit di PD X. Rekapitulasi kuesioner pengamat dan rekapitulasi kuesioner operator dapat dilihat pada Tabel 3 dan 4.

**Tabel 3. Rekapitulasi Kuesioner Pengamat**

| Stasiun Kerja | Punggung |   | Bahu/Lengan |   | Pergelangan Tangan |   | Leher |
|---------------|----------|---|-------------|---|--------------------|---|-------|
|               | A        | B | C           | D | E                  | F | G     |
| Mesin Jahit   | 2        | 2 | 2           | 1 | 2                  | 3 | 3     |

**Tabel 4. Rekapitulasi Kuesioner Operator**

| Stasiun Kerja | Pertanyaan |   |   |   |   |   |   |   |
|---------------|------------|---|---|---|---|---|---|---|
|               | H          | I | J | K | L | M | N | O |
| Mesin Jahit   | 1          | 3 | 1 | 2 | - | - | - | - |

## 2. Pengolahan data

Hasil rekapitulasi perbandingan matriks antara kuesioner operator dan pengamat dapat dilihat pada Tabel 5.

**Tabel 5. Matriks Rekapitulasi**

| Kategori                                       | Score      |
|--|------------|
| Posisi Punggung (A) dan Beban (H)              | 4          |
| Posisi Punggung (A) dan Durasi (I)             | 8          |
| Durasi (I) dan Beban (H)                       | 6          |
| Posisi Statis (B) dan Durasi (I)               | 8          |
| Tinggi (C) dan Beban (H)                       | 4          |
| Tinggi (C) dan Durasi (I)                      | 8          |
| Durasi (I) dan Beban (H)                       | 6          |
| Frekuensi (D) dan Beban (H)                    | 2          |
| Frekuensi (D) dan Durasi (I)                   | 6          |
| Gerakan Berulang (F) dan Kekuatan (J)          | 6          |
| Gerakan Berulang (F) dan Durasi (I)            | 10         |
| Durasi (I) dan Kekuatan (J)                    | 6          |
| Posisi Pergelangan Tangan (E) dan Kekuatan (J) | 4          |
| Posisi Pergelangan Tangan (E) dan Durasi (I)   | 8          |
| Posisi Leher (G) dan Durasi (I)                | 10         |
| Kebutuhan Visual (K) dan Durasi (I)            | 8          |
| <b>Total Score (x)</b>                         | <b>104</b> |

Perhitungan Exposure Level

$$\begin{aligned}
 E &= \frac{x}{x_{max}} \times 100\% \\
 &= \frac{104}{162} \times 100\% \\
 &= 64,19\%
 \end{aligned}$$

### **3.2 Analisis Masalah dan Usulan Perbaikan**

Hasil yang diperoleh dari perhitungan exposure level sebesar 64,19%. Hasil tersebut termasuk kedalam klasifikasi 50-69% yang artinya diperlukan penelitian lebih lanjut dan perbaikan karena stasiun kerja kurang baik dan mulai timbulnya keluhan dari operator. Stasiun kerja dapat diperbaiki dengan memberikan sandaran dan tambahan busa pada dudukan kursi, perbaikan dapat juga melalui dari postur tubuh operator dalam bekerja. Perbaikan postur tubuh operator bisa dilihat dari bagian tubuh yang terasa paling sakit maka bagian tubuh tersebut yang menjadi fokus utama untuk diperbaiki postur tubuhnya.

## **4. KESIMPULAN DAN SARAN**

### **4.1 Kesimpulan**

Hasil perhitunga *Quick Exposure Check* masuk kedalam klasifikasi 50-69% yang artinya diperlukan penelitian lebih lanjut dan perbaikan karena stasiun kerja kurang baik dan mulai timbulnya keluhan dari operator. Stasiun kerja dapat diperbaiki dengan memberikan sandaran dan tambahan busa pada dudukan kursi, perbaikan dapat juga melalui dari postur tubuh operator dalam bekerja. Perbaikan postur tubuh operator bisa dilihat dari bagian tubuh yang terasa paling sakit maka bagian tubuh tersebut yang menjadi fokus utama untuk diperbaiki postur tubuhnya.

### **4.2 Saran**

Saran untuk PD X, sebaiknya lebih ditingkatkan lagi untuk keselamatan kesehatan kerja (K3) pada perusahaan, agar kinerja operator lebih maksimal dan resiko cedera operator berkurang.

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