

Table 5

| No.  |   | 31   | 32      | 33      | 34      | 35       |         |
|--|---|--|---------|---------|---------|----------|---------|
| Steel  |   | D  | D       | D       | D       | G        |         |
| Cold rolling   | First stage                                   | Thickness of the steel plate before rolling mm | 4.0     | 4.0     | 4.0     | 4.0      | 3.0     |
|  |   | Thickness of the steel plate after rolling mm  | 2.5     | 2.0     | 1.5     | 1.0      | 0.35    |
|  |   | Reduction %                                    | 37.5    | 50.0    | 62.5    | 75.0     | 88.3    |
|  | Second stage                                  | Thickness of the steel plate before rolling mm | 2.5     | 2.0     | 1.5     | 1.0      | —       |
|  |   | Thickness of the steel plate after rolling mm  | 0.3     | 0.3     | 0.3     | 0.3      | —       |
|  |   | Reduction %                                    | 88.0    | 85.0    | 80.0    | 70.0     | —       |
| Composition  | C ppm   | < 25   | < 25    | < 25    | < 25    | < 25     |         |
|  | Si %  | 3.01   | 3.00    | 2.99    | 3.01    | 3.5      |         |
|  | Mn %  | 0.64   | 0.63    | 0.65    | 0.63    | 0.3      |         |
| Mn concentration   | Density in the surface %                      | 0.48   | 0.47    | 0.48    | 0.46    | 0.3      |         |
|  | Density ratio in the surface                  | 0.67   | 0.65    | 0.66    | 0.64    | 0.99     |         |
|  | Maximum ratio of reduction %/ $\mu\text{m}$   | 0.006  | 0.006   | 0.006   | 0.006   | < 0.0001 |         |
| Average grain size vs. sheet thickness (ratio)                 |   | 3.1  | 4.2     | 5.3     | 6.1     | 0.6      |         |
| Density ratio of (100) planes parallel to the surface of sheet |   | 53   | 42      | 63      | 56      | 2.3      |         |
| Properties after annealing                                     | Presence or absence of abnormal magnetization |  | absence | absence | absence | absence  | absence |
|  | Magnetic flux density                         | Rolling direction X1 T                         | 1.752   | 1.775   | 1.792   | 1.859    | 1.558   |
|  |   | Direction of the width of plate X2 T           | 1.732   | 1.751   | 1.790   | 1.845    | 1.428   |
|  |   | 45° direction Y T                              | 1.462   | 1.442   | 1.416   | 1.360    | 0.420   |
|  |   | Average value of X1 and X2 X T                 | 1.742   | 1.763   | 1.791   | 1.852    | 1.493   |
|  |   | $2(X-Y)/(X+Y)$                                 | 0.175   | 0.200   | 0.234   | 0.306    | 0.050   |