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Design Selection of Transformer on Based Load Capacities for Industrial Zone

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ABSTRACT

This paper focus on one industrial zone as model of base loads consideration in where many loads power consumption are applied many kinds of transformers and specifications. That will involve the correct design selection for location of transformers and their accessories that are considered inductive loads and capacitive loads are affective active and reactive loads which are depended on their operation of each division. Load design will be important whether to reduce loss or stability of power factor while operation in running time. Load acres, load sizes and load stabilities are selected with many effectives beyond transformers are settlement in each acre. The expected operating characteristics should not be determined at the necessary protection provided.

Keywords: *reactive power, power factor, inductive load, load areas, industrial zone*

1. INTRODUCTION

Design of service condition involves a study of the load, type of load to be supplied, density of consumers, points available for supply of electrical distribution lines, street and road layout, layout of distribution lines along the roads. The main load on the distribution system may be divided into various categories such as residential or domestic load, commercial load, industrial load, municipal load, traction load and etc.

The electrical design of distribution may be subdivided mainly into primary distribution system, distribution transformers, secondary distribution and consumer's service connections [1]. The transformer selection design will involve based on choosing the distribution voltage for primaries, size and location of distribution transformers, type of distribution system of primaries and secondaries, allowable voltage regulation on load, length of the line and size of conductors used for the distribution system.

In primary distribution voltage in Industries are 33kV and secondary distribution voltage are 11kV. The low voltage level for industrial zone is 230V and 400V. In this design, a 33kV line is taken to the load center 33/11kV transformers are installed in their application.

2. MATHEMATICAL REVIEW

For design and calculating the base load of each division of industrial compound are calculated by using following equations. Base Impedance, transformer impedance, transformer per unit impedance base current, actual fault current, short circuit current, short circuit MVA are considered in calculation on based load effects. Firstly consider, maximum possible load current are dependent on maximum power consumption which was calculated in equation (1). The relation of maximum demand or maximum load and average demand are point out calculated because of which is mainly considered the criteria of load consumption that are described from equation (2) to (5).

Maximum possible continuous current,

$$I = \frac{P}{\sqrt{3} \times Cos\theta} \quad (1)$$

Total current = Number of Units Operating Simultaneously × Current per Unit (2)

Maximum Demand or Maximum Load = Number of Units Operating Simultaneous × Supply Voltage (3)

Maximum Demand or Maximum Load = Number of Units Operating Simultaneous ×Current per unit × Supply Voltage (4)

Average Demand or Average Load = Total Current (amps-minute) × Supply Voltage (5)

3. CHARACTRISTIC OF BASED LOAD

The maximum power consumption capability must be in accordance with system requirements. The transformer must be suitable for the environmental conditions and to constructional methods.

The maximum, minimum, average temperature can be caused to increase loss and then mainly consider maximum operating temperature and maximum ambient air temperature, solar absorption coefficient, solar radiation intensity [2].

In order to arrive at an overall evaluation of electrical power requirement, adequate consideration should be given to transient demand requirements which are of a capacity or duration to impair system voltage and/or frequency stability or to exceed short time ratings of power source. The proper selection of characteristics and capacity of power-source components and resulting assurance of satisfactory performance of equipment, under normal, abnormal, emergency operating power conditions.

4. RESULTS DATA OF LOAD CAPACITIES FOR TRANSFORMER SELECTION

In industries loading operation are inductive loads for what power factor assumption are considered minimum rating, 60% and 80% of rated power. Inductive affective is going to found loss of reactive power in which the losses mainly considered the load of transformer according to minimum power factor assumption. Environmental affects considered a little capacitance losses of load reduction therefore it was neglectable the load focus on this paper. The following table are shown selection of transformers nomination with calculated load capacities what of block numbers.

An overall evaluation of electrical power requirement, adequate consideration should be given to transient demand requirements which are of a capacity or duration to impair system voltage and/or frequency stability or to exceed short time ratings of power source.

Table1. Selection of Transformer for Industries

Transformer	Blocks	Capacity of Transformers	Numbers of Transformers	P.F for Factory	Total Demand
No	No	kVA	No	cosø	kW
A	1-2	1000	1	0.6	600
C	3-4	500	1	0.6	300
E	5-6	315	2	0.6	378
F	7-8	250	2	0.6	300
G	9	200	1	0.6	120

Table2. Selection of Transformer for Industries

Transformer	Blocks	Capacity Transformers	Total Transformers	P.F Factory	Total Demand
No	No	kVA	No	cosø	kW
B	10-12	750	1	0.6	450
C	13-16	500	2	0.6	600
E	17-18	315	2	0.6	378
F	19-20	250	2	0.6	300
G	21-23	200	2	0.6	240

Table3. Selection of Transformer for Industries

Transformer	Blocks	Capacity of Transformers	Transformers	Factory(PF)	Total Demand
No	No	kVA	No	cosø	kW
A	24-27	1000	1	0.6	600
B	28-31	750	1	0.6	450
C	32-33	500	1	0.6	300
E	34-35	315	1	0.6	189
F	36-38	250	1	0.6	150
G	39	200	1	0.6	120

Table4. Selection of Transformer for Industries

Transformer	Blocks	Capacity of Transformers	Transformers	Factory(PF)	Total Demand
No	No	kVA	No	cosø	kW
C	40-44	500	1	0.6	400
E	45-47	315	1	0.6	378
F	48-49	250	1	0.6	150
G	50	200	1	0.6	120
H	51	50	1	0.6	30

Table5. Selection of Transformer for Industries

Tr	Blocks	Transformers rating	Transformers	P.F	Total Demand
No	No	kVA	No	cosø	kW
B	52-60	750	3	0.6	1350
D	61-63	400	1	0.6	240
E	64-67	315	2	0.6	378

Table6. Selection of Transformer for Industries

Transformer	Blocks	Transformers (rating)	Transformers	Factory	Total Demand
No	No	kVA	No	cosø	kW
A	68-71	1000	1	0.6	600
B	72-73	750	1	0.6	450
E	74-76	315	2	0.6	378
F	77	250	1	0.6	150

Table7. Selection of Transformer for Industries

Transformer	Blocks	Capacity of Transformers	Numbers of Transformers	P.F for Factory	Total Demand
No	No	kVA	No	cosø	kW
A	68-71	1000	1	0.6	600
B	72-73	750	1	0.6	450
E	74-76	315	2	0.6	378
F	77	250	1	0.6	150

Table8. Selection of Transformer for Industries

Transformer	Blocks	Capacity of Transformers	Numbers of Transformers	P.F for Factory	Total Demand
No	No	kVA	No	cosø	kW
A	68-71	1000	1	0.6	600
B	72-73	750	1	0.6	450
E	74-76	315	2	0.6	378
F	77	250	1	0.6	150

Table9. Calculation of Total Power Demand

No	Supply to Blocks	Transformers (kVA)	Transformers	Factory	Demand
A	1-2,24-27,68-71,90-92	1000	4	0.8	3200
	10-12,28-31,52-60,72-73,78-81,93-97	750	9	0.8	5400
B	3-4,13-16,32-33,40-44,82-84	500	9	0.8	3600
E	61-63	400	1	0.8	320
F	5-6,17-18,34-35,45-47,64-67,74-76,85-87,98-99	315	14	0.8	3528
	7-8,19-20,36-38,48-49,77,88	250	8	0.8	1600
G	9,21-23,39,50,89,100	200	7	0.8	1120
H	51	50	1	0.8	40

Table10. Shows the different types of Industry

No	Name	Acres	Numbers of Transformers	Capacity of Transformer
1	Rice Mill	6	A	1000
2	Oil Mill	5	B	750
3	Steel Mill	4	C	500
4	Cotton Mill	4	D	400
5	People Cigarette	3	E	315
6	Chemical Industries	2	F	250
7	Textile Mill	2	G	200
8	Machine Tools Industries	1	H	50

5. CONCLUSIONS

The different possible base loads are considered that can simultaneously be changed faults, weather affects, suddenly load demands and so on in time varies which all are very important facts. The others; the average load and intermittent load (rms) are rather considered on load suddenly change condition. The proper selection of characteristics and capacity of power-source components and resulting assurance of satisfactory performance of equipment, under normal, abnormal, emergency operating power conditions.

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